Final

RHINEHART TIRE FIRE SITE

Operable Unit 3
Technical Memorandum
Feasibility Study Addendum
Work Assignment No. 037-TATA-0385
Contract No. 68-W6-0025

Prepared for

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103

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1.0 Introduction

1.1 Background

The Rhinehart Tire Fire site is an U.S. Environmental Protection Agency (EPA)-lead Superfund site under EPA Region V Response Action Contract (RAC), Contract No. 68-W6-0025. A feasibility study (FS) for Operable Unit 3 (OU3) was prepared and submitted in March of 1998. The FS evaluated remedial alternatives for the soil (surface and subsurface), sediment (Rhinehart's Pond and the impacted section of Massey Run), and the groundwater. These three media were identified in the Remedial Investigation (RI) (CH2M HILL, February 1998) as posing a potential risk to human health or the environmental.

After analysis of the RI data, EPA and CH2M HILL determined that there were an insufficient number of background samples to accurately conduct a statistical comparison of site groundwater concentration to background concentrations. It was determined that two additional wells were needed to further characterize the background concentrations of inorganics in the groundwater. CH2M HILL was contracted to provide additional technical assistance services that included the installation of one additional background monitoring well couplet (i.e., one deep and one shallow monitoring well), the development of the new background wells, and the collection of two rounds of groundwater samples from the two existing background wells (MW-7S and MW-7D) and the two new background wells (MW-8S and MW-8D). Additionally, CH2M HILL revised the statistical comparison of site groundwater inorganic concentrations and background inorganic concentrations to include the additional groundwater data (CH2M HILL, 2000b). This groundwater statistical comparison indicated that the arsenic, iron and manganese concentrations detected in the groundwater beneath the site are considered to be at levels similar to background. Therefore, the groundwater beneath the site is considered to at background levels and are not considered for remedial action.

Additionally, the RI concluded that the main drivers of soil risk at the site were inorganics. A statistical comparison of the site soil data and the background soil data indicated that the inorganic levels on the site were not statistically above background levels (CH2M HILL, 2000a) as shown in Table 1-1. Therefore, the soil at the site is considered to be background levels and are not considered for remedial action.

Additionally, the RI concluded that the sediment in Rhinehart's Pond and offsite streams posed a potential risk to ecological receptors. EPA's Emergency Response Team (ERT) conducted a sediment toxicity test to evaluate potential threat to aquatic receptors in Rhinehart's Pond and Massey Run. The test identified a threshold concentration for zince in sediment above which an ecological threat is expected to exist of 1,600 mg/kg.

1.2 Purpose of the Technical Memorandum

The purpose of this technical memorandum is to focus the remedial alternatives for the site to those media that presented a potential of unacceptable risks to human health and the environment as addressed in the RI and supplemental statistical evaluation. Specific information regarding site history, physical characteristics, nature and extent of contamination, contaminant fate and transport, and the human health and environmental assessments is available in the RI (CH2M HILL, February 1998) and in the FS (CH2M HILL, March 1998). The discussion is divided into two specific areas: alternatives for sediment in Rhinehart's Pond and Massey Run and remedial actions of common site facilities that are discussed separately. Section 4 summarizes the sediment remedial alternatives and Section 5 summarizes the remedial actions for the site facilities. The two areas are discussed separately to allow an easier comparison of the sediment alternatives.

1.3 Supplemental Nature and Extent of Contamination

One additional background well couplet was installed in December of 1998. The well couplet included one shallow well and one bedrock well. Two rounds of groundwater samples were collected from the two new background wells and also from the two existing background wells. Specific details on the additional background groundwater sampling activities and results are discussed in the *Final Technical Memorandum on Additional Background Groundwater Sampling Activities* (CH2M HILL, 2000b).

Additionally, CH2M HILL collected six soil samples from the benches and four sediment samples from Rhinehart's Pond as part of revision request number 2. The soil samples were collected and analyzed for basic nutrients to determine if any enhancements are required to promote grass growth. Table 1-2 summarizes the basic nutrient results for the soil samples. Figure 1-1 shows the approximate locations of the soil and sediment samples.

The sediment samples were collected from random locations in Rhinehart's Pond. The sediment samples were collected and analyzed for Toxicity Characteristic and Leaching Procedures (TCLP) to determine proper disposal methods for the sediment. Table 1-3 summarizes the TCLP analysis for the sediment samples. All of the TCLP concentrations are below regulatory criteria and not considered a listed waste, therefore, the sediment is considered non-hazardous.

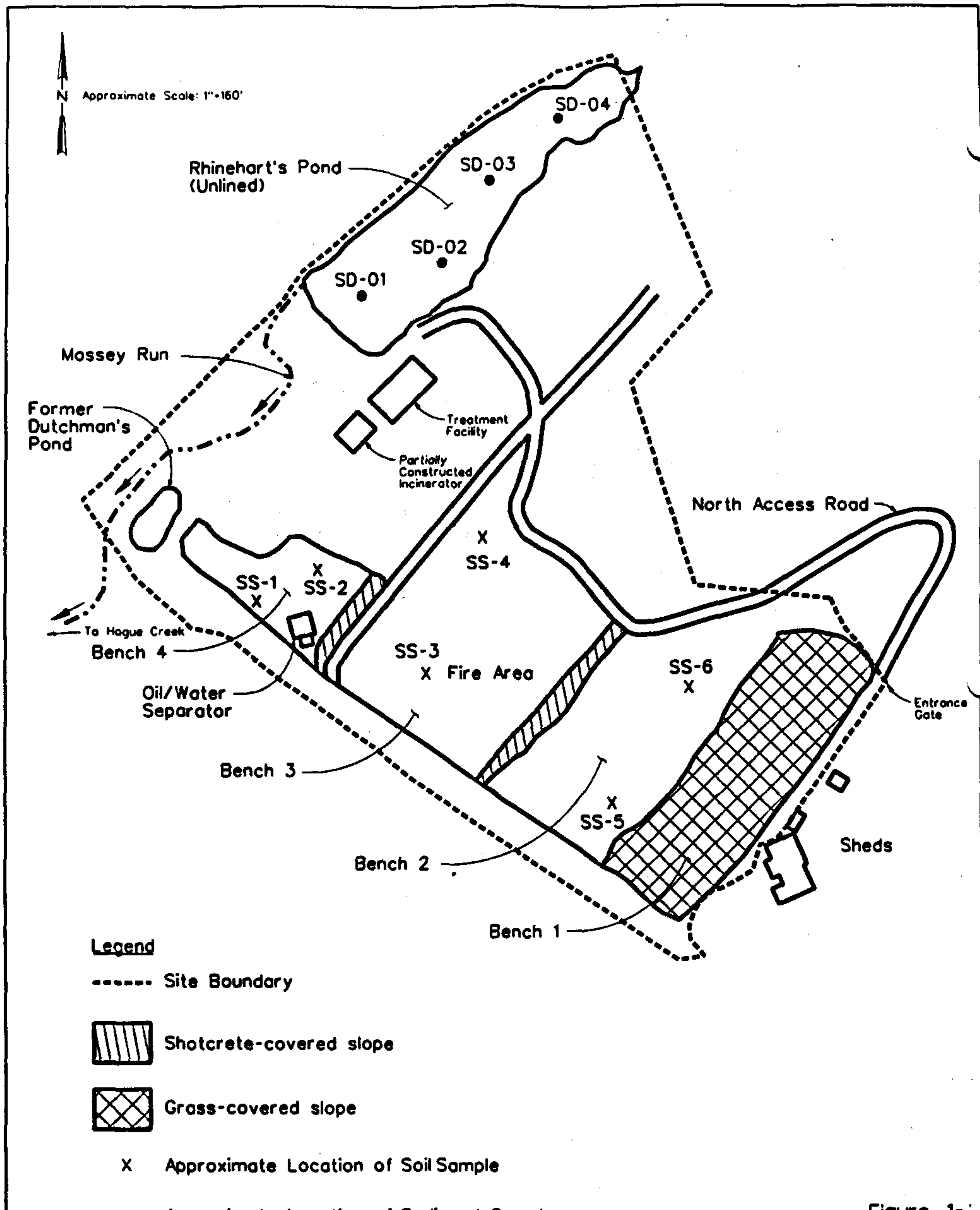

Figure 1-

Soil and Sediment Sampling Locations

Rhinehart Tire Fire Site

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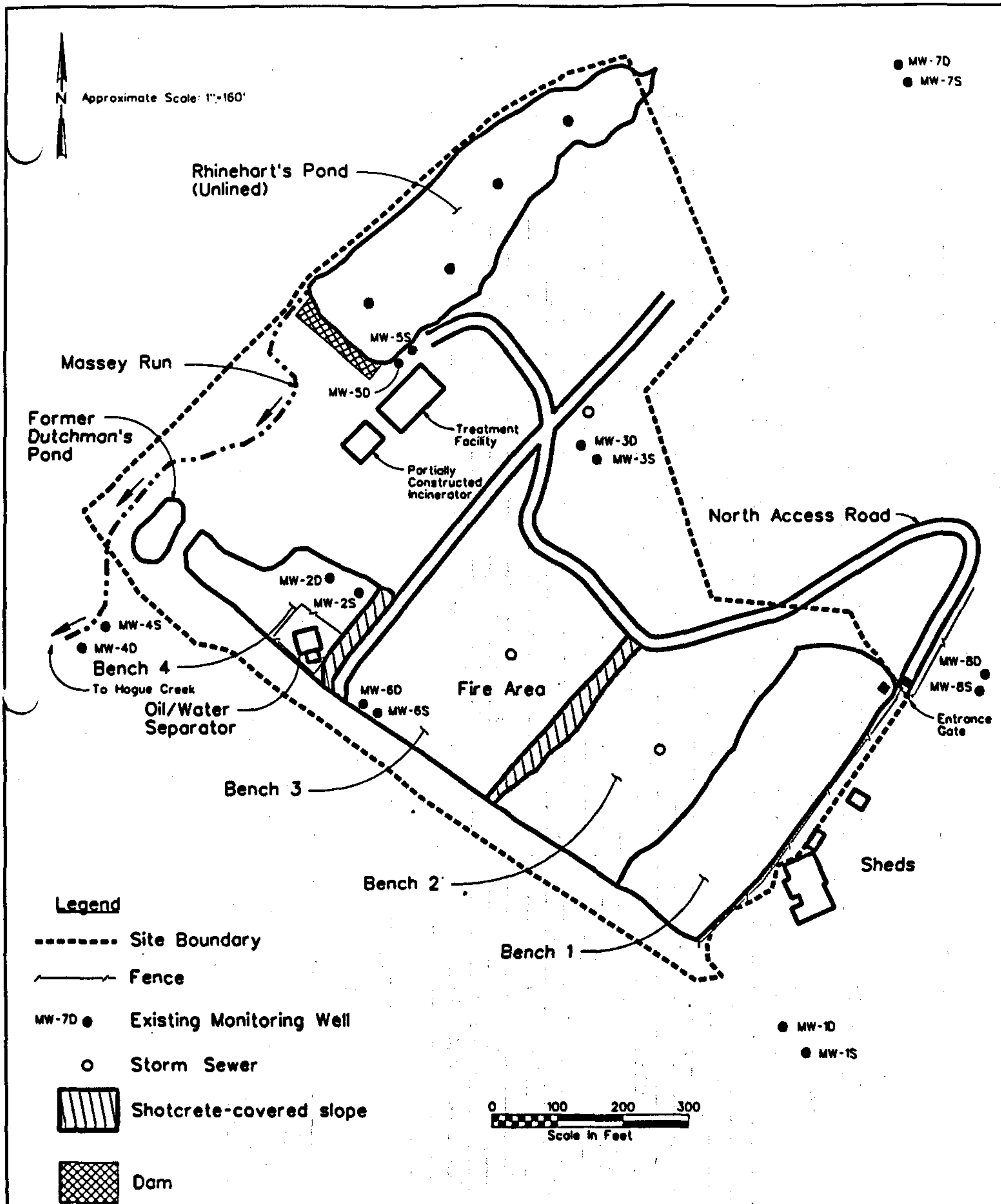

Figure 1-2
Common Site
Feature Location
Rhinehart Tire Fire Site

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Table 1-1
Background Comparison
Rhinehart Tire Fire Site

	Sample Population				Background Data				Statistical Comparison				General Comparison
	Maximum Detected Concentration (max_{site})	Count (n_1)	Mean (x1)	Standard Deviation (s1)	Maximum Detected Concentration (max_{bkg})	Count (n_2)	Mean (x_2)	Standard Deviation (s_2)	Pooled Sample Estimator (sp^2)	Calculated t-value (t)	$t_{0.05}$	Statistically Above Background?	Above Background? (when not enough data for statistical comparison))
Surface Soil													
Arsenic	14.5	6	2.8	3.4	11.6	3	10.9	1.1	8.5	-3.9311	1.895	No (1)	
Beryllium	1.2	6	0.59	0.42	0.91	3	0.80	0.11	0.1	-0.8282	1.895	No	
Iron	39,700	6	15,607	13,072	33,500	3	31,400	1,819	123,000,492	-2.0138	1.895	No (1)	
Surface and Subsurface Soil													
Aluminum	18,700	34	11,840	4,076	13,500	4	13,025	640	15,263,392	-0.5738	1.684	No	
Chromium	31	34	21	6.2	21	4	20	1.0	35	0.3202	1.684	No	
Iron	103,000	34	39,825	19,101	38,300	4	33,125	3,756	335,619,937	0.6919	1.684	No	
Surface Water													
Thallium	6.6	7	3.2	1.5	not detected	8						Yes	
Zinc	1,380	7	205	518	6.0	8	4.1	1.1	123,842	1.1029	1.771	No	
Groundwater*													
Arsenic	12.5	24	5.0	2.9	25.4	12	10.6	9.6				No (1)	
Iron	14,200	24	2,059	3,476	4,860	12	2,339	1,945.0				No (1)	
Manganese	3,500	24	1,405	869	2,500	12	1,310	893	768,431	0.3065	1.689	No	

Calculations:

$$sp^2 = \frac{[(n_1 - 1) * s_1^2] + [(n_2 - 1) * s_2^2]}{n_1 + n_2 - 2}$$

$$t = \frac{(x_1 - x_2) - D_0}{(sp^2 * (1/n_1 + 1/n_2))^{0.5}}$$

The Student t-test was used when both the sample population and the background population have a normal distribution.
If both the site and background populations are lognormally distributed, the data were transformed and the t-test was run.
The one-tailed test was used to determine the $t_{(0.05)}$ value.
D_0 is the hypothesized difference between the means, assuming that there is no difference, D_0=0.
(1) Not considered statistically significant because background data is detected at higher concentrations than site data.
* RI submittal revised to include the additional background groundwater samples collected in 1999.

AR301450

Table 1-2
Basic Nutrient Information for Soil Samples Collected from the Benches
Rhinehart Tire Fire Site

Sample	Bench	Organic Matter		Phosphorus		Potassium		Magnesium		Calcium		pH		Acidity	CEC	Percent Base Saturation				Sulfur (SO4-S)	
Number	Number	%	ENR (lbs/A)	ppm	rate	ppm	rate	ppm	rate	ppm	rate	soil pH	buffer index	H (meq/100g)	meq/100g	K (%)	Mg (%)	Ca (%)	H (%)	ppm	rate
SS-1	4	1.6	76M	5	VL	42	L	54	M	480	M	5.5	6.83	1	4	2.7	11.3	60.2	25.8	13	H
SS-2	4	2.1	86M	3	VL	50	L	76	H	490	M	5.8	6.85	0.8	4	3.2	16	61.8	19	8	M
SS-3	3	1.5	74M	3	VL	32	VL	50	L	590	H	6.1	6.88	0.5	4	2.1	10.4	73.8	13.7	14	H
SS-4	3	1.6	76M	3	VL	37	L	68	M	550	M	5.7	6.84	0.9	4.3	2.2	13.1	63.6	21.1	23	VH
SS-5	2	1.4	71M	4	VL	55	L	83	H	650	H	6	6.86	0.7	4.8	2.9	14.3	67.3	15.4	25	VH
SS-6	2	1.3	69L	3	VL	63	L	75	M	600	M	5.8	6.84	0.9	4.7	3.5	13.4	64.2	19	19	VH

Notes:
Values in this report represent the plant available nutrients
Values are expressed as % (percent), ppm (parts per million), or lbs/A (pounds per acre)
VL = very low, L = low, M = medium, H = high, VH = very high
ENR = Estimated Nitrogen Release
CEC = Cation Exchange Capacity
To convert to lbs/A, multiply the results in ppm by 2.

Table 1-3 **TCLP Analytical Results for Sediment Samples from Rhinehart's Pond** ***Rhinehart Tire Fire Site***					
Sample	**Regulatory Level**	**SD-01**	**SD-02**	**SD-03**	**SD-04**
TCLP Metals (ug/l)					
Arsenic	5,000	30 U	30	30 U	30 U
Lead	5,000	18 B	6 UJ	6 UJ	6 UJ
Barium	100,000	855	922	1100	1170
Cadmium	1,000	5 U	5 U	5 U	5
Mercury	200	1 UL	1 UL	1 UL	1 UL
Selenium	1,000	7 UL	7 UL	7 UL	7 UL
Silver	5,000	11 UL	11 UL	11 UL	11 UL
Chromium	5,000	13 U	13 U	13 U	13 U
TCLP Organics (ug/l)					
Vinyl Chloride	200	25 U	25 U	25 U	25 U
11,-Dichlorethene	700	25 U	25 U	25 U	25 U
Chloroform	6,000	25 U	25 U	25 U	25 U
Carbon Tetrachloride	500	25 U	25 U	25 U	25 U
Benzene	500	25 U	25 U	25 U	25 U
1,2-Dichloroethane	500	25 U	25 U	25 U	25 U
Trichloroethene	500	25 U	25 U	25 U	25 U
Tetrachloroethene	700	25 U	25 U	25 U	25 U
Chlorobenzene	100,000	25 U	25 U	25 U	25 U
2-Butanone	200,000	25 U	25 U	25 U	25 U

U = undetected
J = detected at an estimated concentration below the quantitation limit
L = biased low

2.0 Remedial Action Objectives and Applicable or Relevant and Appropriate Requirements

The general and site-specific remedial action objectives (RAOs), corresponding applicable or relevant and appropriate requirements (ARARs), and the preliminary remediation goals (PRGs) for the contaminated media at the Rhinehart site were discussed in detail in the FS (CH2M HILL, March 1998). Based on the RI conclusions and the subsequent background evaluation, the sediment in Rhinehart's Pond and the impacted section of Massey Run is the only media that poses a potential risk to human health or to the environment.

The ARARs summarized in the Final FS were reviewed for their continued accuracy. A review of the ARARs did not identify any additional ARARs that need to be included in this discussion. The RAOs and ARARs that are applicable to the sediment are included here for completeness. The Final FS has more specific details on the RAO and ARAR determination.

2.1 Site-Specific Cleanup Goals and RAOs for Sediment

The site-specific RAOs for the sediment in Rhinehart's Pond and the impacted section of Massey Run are:

- Prevent ecological exposure to elevated concentrations (>1,600 mg/kg) of zinc in the sediment.
- Prevent migration and leaching of contaminants in the sediment that may contaminate the surface water.

2.2 Chemical-Specific ARARs for Sediment

Chemical-specific ARARs are promulgated standards or levels for a specific chemical.

A site-specific analysis of COPCs based on exposure pathways to sensitive receptors identified in the Ecological Risk Assessments was performed to generate preliminary remediation goals (PRGs). Sediment PRGs were calculated based upon potential risks to ecological receptors, and contaminant concentrations in fish were calculated for monitoring purposes using a fish ingestion scenario.

2.2.1 Sediment PRGs.

Sediment PRGs were determined based on risks to ecological receptors. Of all the metals calculated to pose a potential risk, as determined from EPA's toxicity evaluation, zinc was determined to pose the highest risk to the ecological receptors at the site, and appears to be the driver of the risk found at the site. The threat to aquatic receptors was evaluated using sediment toxicity testing. The toxicity test identified the threshold zinc concentration in sediment above which an ecological threat is expected to exist of between 1,600 and 4,800 mg/kg, dry weight (CH2M HILL, March 1998). Therefore, the most conservative value of

1,600 mg/kg zinc has been established for the PRG in Rhinehart's Pond and the impacted section of Massey Run sediment.

2.2.2 Fish Monitoring PRGs.

In addition, the potential risk to human health as a result of ingestion of fish from Hogue Creek was calculated and identified three inorganics that resulted in potential unacceptable risks. The recommended fish ingestion PRGs (Table 2-1) are intended to be used to monitor contaminant concentrations that bioaccumulate in the fish and to serve as action levels that would trigger more frequent monitoring or additional action at the site.

Table 2-1 Preliminary Remediation Goals Fish Ingestion Scenario Rhinehart Tire Fire Site			
Chemical	Target Organ	Target Hazard Quotient[1]	Recommended PRG (mg/kg)
Manganese	CNS	1.0	1.5E+02
Thallium	Blood	0.5	4.2E-02
Zinc	Blood	0.5	1.6E+02
	Cumulative:[2]	1.0 for CNS	
		1.0 for Blood	

HQ = Hazard quotient

mg/kg = miligrams per kilogram

PRGs = Preliminary Remediation Goals

1 Target hazard quotient (HQ) is dependent on the target organ impacted. The total hazard for an organ cannot exceed 1. If multiple contaminants effect the same organ, the target HQ will be adjusted accordingly. For example, thallium and zinc both impact the blood; therefore, the target hazard for each is 0.5 which will result in a cumulative hazard of 1.

2 Cumulative noncancer hazard is a sum of hazards by target organ. Cumulative cancer risk is a sum of risks for each carcinogenic compound.

3.0 Identification and Screening of Remedial Technologies and Alternatives for Sediment

This section outlines the sediment preliminary RAOs and discusses the general response actions developed to address the sediment preliminary RAOs. The Final FS provides more detail on the identification and screening of the technologies and alternatives. The general response actions and screening of remedial technologies and process options presented in the Final FS were reviewed for their continued accuracy. This review did not identify any appropriate additions.

General response actions are broad classes of responses or remedies developed to meet site-specific remedial action objectives. The RAOs for the sediment in Rhinehart's Pond and the impacted section of Massey Run are discussed below.

3.1 General Response Actions

3.1.1 No Action Alternative

The no action alternative is common to each medium listed below. The no action alternative is required by the National Contingency Plan as a baseline alternative to which all other alternatives are compared.

3.1.2 Sediment

The general response actions listed below have been identified as potentially applicable for remediation of the sediment in Rhinehart's Pond and the impacted section of Massey Run:

- No further action
- Limited action
- Containment
- Removal
- Treatment
- Disposal

No further action for sediment is included in the study for comparative purposes with other actions and to meet NCP requirements.

Limited action is a category of general response actions that can be used singly or as part of an overall remediation alternative. Limited Actions that address ecological risk could include physical barriers such as fencing or bird netting that prevent access to the sediment for certain receptor populations and monitoring of fish to track concentration trends. Institutional controls are generally not as effective at addressing ecological risk as they are at addressing human-health risk.

Containment response actions for sediment include technologies that prevent the migration of, and direct contact with, contaminants. These actions include surface controls and capping. Surface controls include replacing material that was removed, and regrading.

The *removal response action* for sediment is excavation and removal. Sediment would be removed in conjunction with other response actions such as disposal and treatment.

Treatment response actions for sediment would be used to reduce the toxicity, mobility, or volume of the contaminants. Treatment may include physical, chemical, or biological processes. The sediment may be treated *ex situ* or *in situ*.

Disposal response actions for sediment include offsite landfilling in a Subtitle D or C-permitted landfill. Subtitle D landfills are permitted to accept nonhazardous waste and Subtitle C landfills are permitted to accept hazardous waste.

3.2 Identification and Screening of Remedial Technologies and Process Options for Sediment

The next step in the feasibility study process is to identify remedial technologies and process options for each general response action. *Remedial technologies* are the general categories of technologies such as capping, excavation, or physical treatment. *Process options* are the specific processes under each remedial technology.

Technologies and process options that potentially apply have been screened on the basis of their suitability for specific site characteristics as summarized in the Final FS (CH2M HILL, March 1998). The preliminary screening of remedial technologies and process options for sediment from Rhinehart's Pond and impacted areas from Massey Run is shown in Table 3-1. The remedial technologies and process options that were suitable, on the basis of the initial screening, were evaluated in greater detail to eliminate nonviable technologies and options, and to simplify the development of remedial alternatives. The screening evaluation is limited to the effectiveness, implementability, and relative cost of each process option and remedial technology as applied only to the general response actions they are intended to satisfy, and not to the site as a whole. Because of this limitation, the evaluation focuses mainly on effectiveness and less on implementability and cost. Specific remedial technologies or process options were evaluated on the basis of their potential performance relative to other technologies and process options within the same general response action.

3.2.1 Rhinehart's Pond and Massey Run — Sediment

Table 3-2 presents an evaluation of the sediment remediation process options that were retained for sediment in Rhinehart's Pond and the impacted section of Massey Run after the preliminary screening that is discussed in further detail in the Final FS. The discussion below addresses the process options that passed the subsequent evaluation for effectiveness, implementability, and cost.

3.2.1.1 No Action

The no action response is required by the NCP and was retained to provide a basis for comparison with the other actions. The no action response would not reduce the volume, mobility, or toxicity of the contaminants.

3.2.1.2 Limited Action

The limited action process options that were retained after technology evaluation include deed restrictions and fencing, or other methods of limiting access to the site, such as bird netting. None of these options reduce the toxicity, mobility, or volume of sediment contamination, although they can reduce the risk to ecological receptors by diminishing the potential for exposure. This option is likely to be implementable for this site, but may be used in combination with other options.

3.2.1.3 Containment

The objectives of containment options for sediment are to prevent or retard the movement of contaminated sediment off the site, or to prevent the flow of clean surface water from passing through areas where contaminated sediment are present. Containment options are not aimed at reducing the volume or toxicity of contamination.

The containment process option that has been retained for future consideration is placement of a soil and sediment cover over the contaminated sediment. A clean cover material, based upon the composition of the native material, would be placed to eliminate direct ecological exposure to the contaminated sediment, but allow for the continued support of the ecological system. Restoration of the ecological system, which includes the reintroduction and planting of native species in the placed cover, would be required. Scouring of the emplaced soil and sediment cover would be prevented by rip rap beneath the pond's inlet or some other energy dissipator.

3.2.1.4 Removal

Excavation of the sediment can be implemented to remove the contaminated sediment from the pond. Removal would likely require dewatering of the pond in order to limit secondary migration of the contaminated sediment. Excavation can be combined with or without placement of cover material in the removal areas. Placement of the cover would allow the reintroduction of the native ecological community. Sediment removal may require treatment to reduce the volume of free water, prior to disposal.

3.2.1.5 Treatment

Treatment response actions are designed to reduce the toxicity, mobility, or volume of the contaminants in the sediment and to meet feasibility study objectives. The treatment technologies retained for further study are dewatering/stabilization and phytoremediation.

Dewatering/Stabilization. Dewatering/stabilization is a process used for the management and treatment of viscous fluids, solids, and contaminated soil. Dewatering/stabilization can be used to manage the removed materials by mixing the sediment with stabilizing reagents. This process would be implemented to make the removed material manageable and to render the sediment nonhazardous and nonleachable.

Phytoremediation. Phytoremediation consists of using plants to clean up contaminated soil and groundwater, taking advantage of a plant's natural abilities to take up, accumulate, and/or degrade constituents from the soil and water environments. This alternative for sediment includes the following major components:

- Performing a treatability study
- Dewatering pond
- Building an earth dam allowing for at least half of the pond to hold water; moving contaminated sediment to the other "dry" side of the dam
- Planting constituent and site-specific plants
- Irrigating and maintaining crops
- Collecting confirmatory soil samples to verify achievement of risk-based remedial action levels after performing phytoremediation
- Disposing of dead plant tissue
- Long-term monitoring

Effectiveness. Based on current literature, Indian mustard (*Brassica juncea*) would be the best plant for uptake of zinc, the metal with highest concentrations in Rhinehart's Pond. Most *Brassica* plants require relatively moist soil for good growth. Based on site conditions (projected sediment/soil depth and evapotranspiration rates), it is important that irrigation be provided to aid plant growth. A complete soil fertility analysis should be conducted on the sediment to determine feasibility of plant uptake.

Effectiveness will be affected by soil matrix, moisture content, concentrations of the target compounds, and uptake capability of *Brassica* plant. Preliminary calculations suggest cleanup time on the upwards of 25 years, but the only way to accurately gauge time to clean up is to perform a treatability study. For this study, some contaminated sediment would be moved to a specialty contractor's greenhouse, and the *Brassica* would be planted and monitored. In this way, zinc uptake rates can be determined.

Implementability. Phytoremediation is an innovative treatment technology, but has not been used extensively for sediment remediation. Because the consistency of pond sediment, it may be necessary to add clean, dry soil to create a medium suitable for sustained plant growth. Standard construction equipment can be used for the planting and irrigation activities, but a specialty contractor would be required to implement the technique. There are long-term monitoring and administrative requirements.

Cost. Preliminary cost analyses performed for phytoremediation indicate that implementing this option would be substantially more costly than other alternatives, without providing a significantly greater benefit. Annual disposal costs for dead plant material and site monitoring and maintenance make up the greatest part of these costs.

Conclusions. Without performance of a treatability study, it is unknown whether phytoremediation would be successful at removing zinc from sediment. For several reasons, this site does not appear to be a good candidate for phytoremediation.

- A relatively long period may be required for cleanup, with ongoing concerns for maintenance and liability for the remediation area.
- The best known crop for zinc uptake requires fairly intensive management (frequent harvests and replanting).
- The shallow soil depth makes irrigation essential. The irrigation system is not expensive, but will require maintenance and automated soil moisture monitoring for irrigation scheduling.
- The addition of clean soil to provide adequate soil volume may greatly increase the total volume requiring conventional treatment if the phytoextraction system fails.
- Ecological risk factors for these systems are not well known.
- Preliminary costs for phytoremediation exceed estimated excavation/removal and capping costs.

On the basis of these conclusions, photoremediation has been screened out of a detailed analysis.

3.2.1.6 Disposal

Disposal response actions were developed as the final step in meeting remedial objectives. Offsite disposal at nonhazardous waste landfills has been retained as a possible way to dispose of the material. Based on RI sediment concentrations, it is expected that the sediment will be characterized as nonhazardous.

Nonhazardous wastes can be disposed of at a permitted Subtitle D nonhazardous landfill. Disposal in a nonhazardous landfill is subject to space availability and acceptance of the waste. Costs associated with disposal in a nonhazardous landfill, if space is available, are considered relatively low when compared with a hazardous waste landfill. Sediment may need to be dewatered or stabilized prior to disposal to meet landfill moisture content requirements.

Before offsite disposal, sediment will be characterized by the TCLP test. If the material is characterized as a hazardous waste, the material will need to be disposed of in a permitted Subtitle C landfill, and may be subject to LDRs. The costs associated with disposal in these facilities are high because of disposal fees and transportation costs to the facility.

3.3 Development of Remedial Alternatives

The next step in the feasibility study process is to group remedial process technologies that remain after the screening process into media-specific remedial action alternatives. The media unit is sediment from Rhinehart's Pond and the impacted section of Massey Run.

3.3.1 Rhinehart's Pond and Massey Run—Sediment

Sediment remediation alternatives were developed for the Rhinehart's Pond and the impacted section of Massey Run on the basis of identification and screening of technology types and process options discussed in this section.

The remedial alternatives identified for further evaluation are described in Table 3-3 and include the following options for the sediment:

- Alternative RHP S-1—No Action
- Alternative RHP S-2—Limited Action
- Alternative RHP S-3—Capping with Institutional Controls
- Alternative RHP S-4—Removal of Contaminated Sediment, Transportation, and Offsite Disposal

These media-specific alternatives are evaluated below on the basis of effectiveness, implementability, and cost. Table 3-3 provides a summary of this evaluation for each alternative.

3.3.3.1 Alternative RHP S-1—No Action

Description. The no action alternative, required by the NCP, is the baseline alternative against which the effectiveness of other remedial alternatives can be compared. Under this alternative, no additional control or remediation would take place. The contaminated sediment would remain in place.

Effectiveness. This alternative does not achieve the RAOs or ARARs for the impact on surface water. Contaminated sediment would remain in place and act as a continuing source of surface water contamination.

Implementability. The no action alternative is easily implemented.

Cost. There are no capital or O&M costs for the no action alternative.

Conclusions. This alternative will not fully meet the RAOs and provides no reduction in the volume, toxicity, or mobility of contaminants. The no action alternative will be retained as required by the NCP to serve as a baseline.

3.3.3.2 Alternative RHP S-2—Limited Action

Description. This alternative leaves the contaminated sediment in place. The major components of this alternative include the following:

- Deed restrictions would be imposed to prevent future land use and excavation in areas of sediment contamination.
- Adding fencing, bird netting, or other barriers to prevent exposure.
- Monitoring of fish to observe concentration trends as a result of site activities.
- Since this alternative results in contaminated media remaining onsite, CERCLA, as amended by SARA (1986), would require that the site be reviewed every 5 years.

Effectiveness. The potential for receptor exposure to contaminants could be reduced under this alternative. However, fencing will not completely deter trespassers and would not prevent smaller animals from entering the site. Bird netting or other barriers may be required. This alternative does not provide for the removal or treatment of contaminated sediment. Ecological exposure to contaminants may be reduced, depending upon the population that is at risk. This alternative may not fully meet the RAOs, which include preventing ecological exposure to, and migration of, contaminants.

Implementability. Alternative RHP S-2 would be easy to implement technically. Fencing and bird netting can be constructed using standard equipment. Institutional administration would be required to manage the 5-year site reviews and to maintain deed restrictions. Maintenance of the site barriers would be required.

Cost. The capital costs for this alternative are low. The operation and maintenance costs are low.

Conclusions. This alternative does not produce a reduction in volume, toxicity, or mobility of contaminants. A reduction in the ecological exposure to contaminants through access restrictions is possible, depending on the population at risk. This alternative will be retained.

3.3.3.3 Alternative RHP S-3—Capping with Limited Action

Description. This alternative consists of installing a clean soil/sediment cap over areas of contaminated sediment. Alternative RHP S-3 is considered a partial-containment alternative, which reduces the risk of ecological exposure to contaminated sediment. Placement of cover material that is based upon the composition of the native material, will allow the new cover material to support the same ecological system as the existing contaminated sediment. This alternative for sediment includes the following major components:

- Deed restrictions to prevent future land use and excavation in areas of sediment contamination
- The sediment would be graded to promote proper drainage
- Dewatering of the pond
- Construction of a cap over the contaminated sediment
- Regrading of areas surrounding the cap to reduce migration of the sediment

Effectiveness. This containment alternative would reduce the potential risk to ecological receptors under current and future land-use scenarios through capping and deed restrictions. No provision is made for the removal or treatment of contaminated sediment. The cap option reduces the mobility of contaminants in the sediment by reducing contact with surface water and it reduces the ecological exposure to contaminants by placement of clean sediment to support the ecological system. There would be no reduction in volume or toxicity of contaminated sediment under this alternative. This alternative effectively reduces the risk of ecological exposure to contaminants in the sediment.

Implementability. Installation of the cap may be somewhat difficult to implement. The placement of sediment would be done using standard construction equipment and procedures. However, care would need to be taken to avoid differential settling issues and limit the spread of contaminated sediment during placement of the cover material. An

O&M program would be easily implemented, but would require the expenditure of long-term administrative resources.

Cost. The capital costs of this alternative are low to moderate. Operation and maintenance costs for the cap are low.

Conclusions. Alternative RHP S-3 will be retained for further evaluation since capping would provide containment of the contaminants of concern and effectively eliminate the risk of ecological exposure to contaminants.

3.3.3.4 Alternative RHP S-4—Removal of Contaminated Sediment, Transportation, and Offsite Disposal

Description. This alternative consists of excavating and removing contaminated sediment, dewatering and/or stabilizing the sediment (if necessary), and disposal of the sediment at a Subtitle D landfill, as appropriate based on soil characterization. This alternative may be combined with the placement of clean sediment, which will support the existing ecological system. This alternative for sediment includes the following major components:

- Dewatering of the pond
- Removing of contaminated sediment
- Performing a treatability study to determine if moisture content of sediment will meet disposal requirements
- Dewatering/stabilization of removed sediment (if required)
- Disposal of treated sediment at a Subtitle D landfill, as appropriate
- Placement of clean sediment in pond

Effectiveness. This alternative would attain risk-based remedial action levels for the sediment. This alternative will achieve a significant reduction in toxicity, mobility, and volume of the contaminants at the site. This alternative may be used with other options, such as capping and institutional controls.

Implementability. Removing and transportation are technically simple to implement. Dewatering/stabilization is an established remedial practice, but may require a specialty contractor. Sediment disposal may be subject to the LDRs. Long-term administrative requirements are not associated with this alternative.

Cost. The capital costs of this alternative are moderate to high. There are no operation and maintenance costs.

Conclusions. Alternative RHP S-4 attains risk-based remedial action levels and achieves a significant reduction in toxicity, mobility, and volume of the contaminants. This alternative will be retained for further evaluation.

Table 3-1
Preliminary Screening of Remedial Technologies for Sediment-Rhinehart's Pond and Impacted Section of Massey Run
Rhinehart Tire Fire Site

General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action		Screening Comments
				Retain	Reject	
No Action	None	Not applicable	No action.	X		Retain as baseline alternative.
Institutional Controls	Access restrictions	Fence or otherwise restrict area	Fence site to restrict access.	X		Technically feasible. Effectiveness based on receptor population present at the site.
	Administrative restrictions	Deed restrictions	Deed restrictions permanently prohibit certain activities on the property.	X		Technically feasible. Would likely be combined with access restrictions.
Containment	Capping	Impervious cap	Cap constructed with a geomembrane, bituminous concrete, GCL or RCRA cap (composite clay and geomembrane with drainage layer).		X	Technically feasible. But would eliminate pond as a viable habitat area.
		Permeable cap	Cap constructed with clean fill based on composition of native material.	X		Technically feasible.
Removal	Excavation	Standard excavation equipment	Effective and reliable method of sediment removal. May increase short-term exposure.	X		Technically feasible.
Ex situ Treatment	Physical treatment	Onsite thermal desorption	*Ex situ* - remove contaminated soil for onsite treatment and re-use as backfill. Desorbs organic compounds from soil at 200 °F to 600 °F.		X	Technically not feasible because of the nature of inorganic contamination.
		Offsite thermal destruction	*Ex situ* - remove contaminated soil for offsite treatment and disposal. Desorbs organic compounds from soil at 500°F to 1,000°F.		X	Technically not feasible because of the nature of inorganic contamination.
		Incineration (offsite)	*Ex situ* - remove contaminated soil for offsite treatment and disposal. High temperatures used to oxidize and thermally destroy organic compounds.		X	Technically not feasible because of the nature of inorganic contamination.
	Chemical treatment	Dewatering/stabilization	Dewater sediment and stabilize if necessary to render the material nonleachable.	X		Technically feasible. Dewatering/ stabilization of inorganics is a proven technology.
In situ Treatment	Biological treatment	Phytoremediation	Plants are used to take up, accumulate, and/or degrade constituents from the soil and water environments.	X		Technically feasible. Innovative technology, effective for inorganic contamination.
Disposal	Landfill	Nonhazardous waste landfill (offsite)	Transport and dispose of untreated or treated material in an approved hazardous waste landfill (Subtitle D).	X		Technically feasible, but sediment will be subject to LDRs, and may require stabilization for moisture removal prior to disposal.

Table 3-2
Evaluation of Remedial Process Options for Sediment-Rhinehart's Pond and Impacted Section of Massey Run
Rhinehart Tire Fire Site

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Cost	Evaluation Action		Screening Comments
						Retain	Reject	
No Action	None	*Not applicable*	*Not effective. Does not* meet remedial action objectives.	Easily *implemented.* Alternative required by NCP.	None	X		Retain as baseline alternative.
Institutional Controls	Access restrictions	Fence site	Deters unauthorized *access to site and* prevents direct contact with sediment by humans and larger animals. Not protective of ecological resources.	Easily implemented.	Low capital, low O&M	X		May be used with other technologies.
	Administrative restrictions	Deed restrictions	Does not reduce contamination. Effectiveness depends on continued implementation. Does not deter unauthorized access to the site or prevent direct contact with sediment. Not protective of ecological resources.	Legal requirements and authority required.	Low capital, no O&M	X		May be used with other technologies.
Containment	Capping	Permeable cap	Effective in preventing contact with sediment contaminants for ecological receptors.	Easily implemented. Requires dewatering for construction.	Low to moderate capital, low O&M	X		Prevents contact with sediment for ecological receptors but allows continued support of ecological system.
Removal	Excavation	Standard excavating equipment	Effective and reliable method of sediment removal. May increase short-term exposure.	Proven technology. Easily implemented.	Low capital, no O&M	X		Required by many treatment and disposal technologies.
Treatment	Chemical treatment	Dewatering/ stabilization	Effective in significantly reducing the mobility of contaminants in sediment. Effectiveness is dependent on soil matrix, grain size, and moisture content.	Dewatering/ stabilization is an established soil management practice.	High capital, no O&M	X		Dewatering/ stabilization would render the sediment manageable prior to *disposal. Treatability* study may be required

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Table 3-2
Evaluation of Remedial Process Options for Sediment-Rhinehart's Pond and Impacted Section of Massey Run
Rhinehart Tire Fire Site

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Cost	Evaluation Action		Screening Comments
						Retain	Reject	
Treatment	Biological treatment	Phytoremediation	Certain plants have proven to be effective in reducing the toxicity, mobility, and volume of contaminants in sediment. At higher levels of zinc contamination as in the Rhinehart's Pond sediment, phytoremediation may require a long time for achievement of remedial goals (over 100 years). A treatability study would need to be conducted to determine if zinc uptake would be successful at the site, and to determine an estimated time to clean up and cost. Phytoremediation may not be effective in reducing ecological risk-based exposures.	Innovative technology. Specialty contractor required. Treatability study required. Irrigation and disposal of dead plant tissue will be recurring O&M issues. Time to clean up is unknown.	Low capital, low O&M		X	Long-term O&M, and long time required to attain RAOs. Preliminary cost estimates indicate that phytoremediation will not be cost competitive.
Disposal	Landfill	Nonhazardous waste landfill (offsite)	Removes contaminants from the site.	Subject to landfill acceptance.	Low to high capital, no O&M	X		Potentially viable. Subject to regulatory constraints.

Table 3-3
Remedial Action Alternatives Screening for Sediment—Rhinehart's Pond and Impacted Section of Massey Run
Rhinehart Tire Fire Site

	Alternative	Effectiveness	Implementability	Cost	Screening Action: Retain	Screening Action: Reject	Comments
RHP S-1	No Action	Not effective. Does not meet remedial action objectives.	Easily implemented. Alternative required by NCP.	None.	X		Retain as baseline alternative.
RHP S-2	Institutional Controls	Reduces potential for direct contact through access barriers. No reduction in mobility, toxicity, or volume of contamination. Does not meet all RAOs.	Fencing and bird netting are standard construction practices and are easily implemented. Legal requirements and authority are required for deed restrictions.	Low capital, low O&M.	X		Limits exposure through limitations on site access; however, may not eliminate ecological exposure risks for all receptor populations. May be used in conjunction with other alternatives.
RHP S-3	Capping	Reduces potential risk to ecological receptors under current land use scenarios. Does not treat contaminated media. Does not reduce soil toxicity or volume. Both the mobility of contaminants and the ecological exposure to contaminants are reduced by placement of clean sediment, which will allow for the restoration of the ecological system.	Challenging to implement. Standard construction equipment required for placement of cover, but care required to avoid spreading of contaminated sediment.	Low to moderate capital, low O&M	X		Sediment cover would provide containment and reduce mobility of contaminants, and would eliminate ecological risk exposure.
RHP S-4	Removal of Contaminated Sediment, Transportation, and Offsite Disposal	Attains risk-based remedial action levels and achieves a significant reduction in toxicity, mobility, and volume of contaminants.	Excavation is technically simple to implement. Dewatering/ stabilization of dredged sediment may be required to manage the materials prior to disposal.	Moderate to high capital, no O&M	X		Eliminates ecological risk by reducing toxicity, mobility and volume of contaminants.

4.0 Detailed Analysis of Remedial Alternatives for Sediments

In Section 3, media-specific alternatives were evaluated on the basis of effectiveness, implementability, and cost. The media-specific remedial alternatives that passed the screening of alternatives will be evaluated in detail in this section. The evaluation criteria used for the analysis are detailed in the Final FS (CH2M HILL, March 1998). Only the alternatives for the sediment in Rhinehart's Pond and the impacted area of Massey Run are presented in this Memorandum.

4.1 Detailed Analysis of Sediment Alternatives

4.1.1 Rhinehart's Pond Sediment Alternatives

The remedial alternatives selected for detailed analysis for Rhinehart's Pond and impacted Massey Run stream sediment are as follows:

- Alternative RHP S-1—No Action
- Alternative RHP S-2—Limited Action
- Alternative RHP S-3—Capping
- Alternative RHP S-4—Removing of Contaminated Sediment, Stabilization (if needed), and Disposal at a Subtitle D Landfill

Key elements of each alternative were evaluated during the detailed analysis. The key elements of each sediment alternative are presented below. These elements are considered critical for determining the success of the alternative in meeting the remediation goals for the sediment or have the greatest influence on the costs of the alternative.

One common element of RHP-2 and RHP-3 sediment alternatives is fish tissue monitoring. EPA has requested that fish from Hogûe Creek be monitored annually for at least 5 years to monitor the potential bioaccumulation of inorganic contaminants in fish tissue. A potential human health risk exists for the ingestion of fish tissue that contains contaminants in concentrations greater than the PRGs outlined in Section 2 of the Final FS (CH2M HILL, March 1998). Hogue Creek is classified as a trout put-and-take stream; therefore, trout has been identified as the target fish to be monitored. If the monitoring reveals contaminant concentrations in the fish tissue above PRG values, additional or more frequent monitoring may be required. If the PRGs are exceeded during multiple sampling events, additional actions may be required at the site. Per discussions with EPA, the fish monitoring was excluded from Alternative RHP-4 because the source of contamination (sediment in Rhinehart's Pond and Massey Run) will be removed and the water will be treated prior to discharge.

According to the Virginia Department of Fish and Wildlife, Hogue Creek is restocked with trout eight times a year. To minimize the potential for a false positive concentration during the annual monitoring, samples of trout should be collected and analyzed during each restocking effort. This screening will create a baseline for contaminant concentrations in the tissue of fish being introduced to the creek, and can be used to compare the concentrations from the annual monitoring of fish from Hogue Creek.

Costs for the fish tissue monitoring program have been included in each RHP sediment remedial alternative analysis and are included in the cost estimate tables in Appendix A.

4.1.1.1 Alternative RHP S-1—No Action

The no action alternative, required by the NCP, is the baseline alternative against which the effectiveness of other remedial alternatives can be compared. Under this alternative, controls or remedial technologies would not be implemented. The contaminated sediment would remain in place. Because contaminated media would be left on the site, a review of the site conditions would be required every 5 years. The review is specified in the NCP. Table 4-1 presents a summary of Alternative RHP S-1 evaluated against the seven criteria presented below.

Overall Protection of Human Health and the Environment. Implementation of Alternative RHP S-1 would not protect human health or the environment. The risk posed from contaminated media would not be reduced. The risk of potential exposure would continue from the contaminated sediment. Any migration of contamination would continue through sediment-contaminated leaching and surface water migration. This alternative does not achieve the RAOs for the prevention of ecological exposure to the contaminants or for the prevention of contaminant leaching to surface water.

Compliance with ARARs. ***Chemical-Specific ARARs.*** This alternative fails to comply with the chemical-specific ARARs for Rhinehart's Pond and the impacted section of Massey Run because all contaminants are left in place under this alternative. Zinc concentrations in sediment consistently exceed the cleanup goal of 1,600 mg/kg.

Location-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs and their regulatory citations are presented in the Final FS (CH2M HILL, March 1998). This alternative fails to comply with location-specific ARARs because contaminated sediment will remain in place. Wetlands, ecological receptors, and surface water bodies subject to the Clean Water Act and state water policies would potentially remain at risk under this alternative.

Action-Specific ARARs. Action-specific ARARs are not directly applicable because no action will be undertaken in this alternative that will adequately protect public health and the environment.

Long-Term Effectiveness and Performance. Alternative RHP S-1—No Action does not achieve RAOs to protect ecological receptors and prevent migration and leaching of contaminants in the sediment that may contaminate the surface water. Alternative RHP S-1 is not effective over the long term in protecting the environment.

Reduction of Toxicity, Mobility, and Volume. Under Alternative RHP S-1—No Action, all sediment contaminants remain in place. This alternative does not reduce the toxicity, mobility, or volume of the contaminants.

Short-Term Effectiveness. Alternative RHP S-1 is not effective in the short term in protecting the environment. Under this alternative, contaminants remain in place.

Implementability. Alternative RHP S-1—No Action is easily implemented. Under this alternative, there is no change from existing conditions.

Cost. There are no initial capital costs or operation and maintenance costs associated with this alternative. In accordance with NCP requirements, a review of the site conditions would be required every 5 years. It is estimated that the cost of this review would be $18,800. A cost summary for all alternatives is presented in Table 4-2.

4.1.1.2 Alternative RHP S-2—Limited Action

This alternative leaves the contaminated sediment of Rhinehart's Pond and the impacted section of Massey Run. The major components of this alternative include the following:

- Deed restrictions would be imposed to prevent future land use and excavation in areas of contamination.
- Security measures would include installing a chain-link fence around the perimeter of the pond. Warning signs would be posted around the perimeter at 100-foot intervals.
- Bird netting could be placed over the fenced enclosure to help prevent ecological risks.
- This alternative results in contaminated media remaining onsite, so CERCLA, as amended by SARA (1986), requires that the site be reviewed every 5 years.

This alternative also includes the monitoring of fish tissue (trout) from Hogue Creek annually for 5 years, as discussed above.

Overall Protection of Human Health and the Environment. The potential for ecological exposure to contaminants would be reduced under this alternative; however, fencing will not completely deter trespassers and would not prevent smaller animals from entering the site. This alternative does not provide for the removal or treatment of contaminated sediment or reduce the migration and leaching of contaminants to surface water and groundwater. This alternative would not meet the RAOs for the site.

Compliance with ARARs. ***Chemical-Specific ARARs.*** This alternative fails to comply with the chemical-specific ARARs for Rhinehart's Pond and Massey Run because all contaminants are left in place under this alternative.

Location-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs and their regulatory citations are presented in the Final FS (CH2M HILL, March 1998). This alternative fails to comply with location-specific ARARs because contaminated sediment will remain in place. Wetlands, ecological receptors, and surface water bodies subject to the Clean Water Act and state water policies would potentially remain at risk under this alternative.

Action-Specific ARARs. Action-specific ARARs are not directly applicable because no action will be undertaken in this alternative that will adequately protect public health and the environment.

Long-Term Effectiveness and Performance. Alternative RHP S-2—Limited Action does not achieve RAOs, which will prevent ecological exposure to sediment contaminants and prevent migration and leaching of contaminants in the sediment that may contaminate the surface water. Although Alternative RHP S-2 may reduce some ecological exposure to sediment contaminants, it is not effective over the long term in protecting the environment.

Reduction of Toxicity, Mobility, and Volume. Under Alternative RHP S-2—Limited Action, all sediment contaminants remain in place. This alternative does not reduce the toxicity, mobility, or volume of the contaminants.

Short-Term Effectiveness. Alternative RHP S-2 may reduce ecological receptor exposure to contaminants upon completion of fencing and installation of netting. Surface water will remain in contact with contaminated sediment. Minimal effects to the environment are expected to occur due to implementation of institutional controls.

Implementability. ***Technical Feasibility.*** Alternative RHP S-2 would be technically easy to implement. Fencing may require a small amount of excavation in contaminated sediment to set fence posts; however, workers installing will be protected with appropriate PPE.

Administrative Feasibility. Institutional administration would be required to manage the 5-year site reviews and to maintain deed restrictions.

Availability of Services and Materials. Fencing materials are readily available and can be installed using common construction activities. Bird netting can be attained from specialty distributors.

Cost. The capital costs for this alternative are estimated to be $59,000. The operation and maintenance costs for the first 5 years because fish tissue will be monitored are estimated to be $35,000 per year. After the first 5 years, annual operation and maintenance costs are estimated to be $12,500. The cost of six 5-year reviews was estimated at $18,800 each. The present worth, based on a 5 percent discount rate, is $400,000. Costing assumptions for Alternative RHP S-2—Limited Action are listed in Appendix A, and a cost estimate for all alternatives is presented in Table 4-2.

4.1.1.3 Alternative RHP S-3—Capping

This alternative consists of installing a cap over areas of contaminated sediment in Rhinehart's Pond. Figure 4-6 presents this alternative conceptually. Alternative RHP S-3 is considered a partial-containment alternative that reduces the risk of ecological exposure to contaminated sediment. This alternative for sediment includes the following major components:

- Deed restrictions to prevent future land use and excavation in areas of sediment contamination
- Dewatering of the pond
- Excavating the impacted section of Massey Run and adding the sediment to Rhinehart's Pond

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- Construction of a cap over the contaminated sediment, which will include a 10-ounce geotextile, 6-inch layer of sand gravel, and a 6-inch layer of wetlands soil mix
- Regrading of areas surrounding the cap to reduce migration of the sediment
- Site access restriction during cap construction

Prior to sediment removal action, the water from the pond will be pumped down and treated in the on-site treatment plant. Treated water will be discharged to Massey Run.

Following dewatering, the bottom sediments will be prepared for capping by leveling the surface of the sediments and removing any bulky materials such as large rocks or stumps. A long-reach hydraulic excavator can be used to accomplish this leveling. Sediments removed from Massey Run would be incorporated in the leveled sediment surface in the pond. A geotextile fabric would then be deployed in large presewn sections, or panels, over the pond sediment surface. Overlying fill materials, including sand and a topsoil mixture, would then be carefully placed over the geotextile in a uniform manner. Uniform placement of the capping soil materials over the geotextile will cause the geotextile to "bridge" over the softer sediment surface, and will allow adequate quality control to maintain uniform placement of capping materials. Placement of cover material that is based on the composition of the native material will allow the new cover material to support the same ecological system as the existing contaminated sediment. Borrow sediment can be attained from dredging activities in the area, or from other local borrow sources or vendors. Additionally, native plants will be planted in the cap materials, as appropriate, during the restoration of the pond.

This alternative also includes the monitoring of fish tissue (trout) from Hogue Creek annually for 5 years, as discussed above.

Overall Protection of Human Health and the Environment. This containment alternative would reduce the potential risk to ecological receptors under current and future land-use scenarios through capping and deed restrictions. No provision is made for the removal or treatment of contaminated sediment. Alternative RHP S-3—Capping may achieve RAOs for sediment at the site. The cap option reduces the mobility of contaminants in the sediment by reducing contact with surface water, and it reduces the ecological exposure to contaminants by placement of clean sediment to support the ecological system. This alternative effectively reduces the risk of ecological exposure to contaminants in the sediment.

Compliance with ARARs. ***Chemical-Specific ARARs.*** Installing a cap over contaminated sediment from Rhinehart's Pond and Massey Run will significantly reduce exposure pathways through direct contact to contaminated sediment. No reduction of contaminant concentrations will occur.

Location-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs, and their regulatory citations are presented in the Final FS (CH2M HILL, March 1998). All location-specific ARARs will be met by Alternative RHP S-3. Capping contaminated sediment will significantly reduce the migration potential of zinc, and will help protect surface waters and ecological receptors from the effects of high concentrations of the metal.

Action-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs, and their regulatory citations are presented in the Final FS (CH2M HILL, March 1998). All action-specific ARARs will be met by this alternative. Stormwater controls will be constructed, dust control measures will be taken, and potentially contaminated runoff will be contained. Occupational Safety and Health regulations will be complied with during capping activities.

Section 121(c) of CERCLA, as amended, requires a periodic review of remedial actions at least every 5 years for as long as contaminants that pose a threat to human health and the environment remain on the site.

Long-Term Effectiveness and Performance. Alternative RHP S-3—Capping should remain effective over the long term with proper maintenance of the cap. Cap performance will be aided by selection of fill material, which will be chosen based on existing sediment conditions. The cap will be constructed of a 10-ounce geotextile fabric, a 6-inch layer of sand gravel, and a 6-inch layer of wetlands soil mix. Upon cap completion, the pond will be vegetated with native plants to control erosion. Vegetation will simulate surrounding wetland plants to achieve the long-term goal of restoring the habitat to precontamination conditions.

Reduction of Toxicity, Mobility, and Volume. Alternative RHP S-3—Capping will not reduce the toxicity or volume of the sediment contamination. It will minimize contact between ecological receptors and contaminants. In addition, it will minimize mobility of contaminants by suppressing leaching of contaminants in the sediment to surface water.

Short-Term Effectiveness. During cap installation, workers will be exposed to contaminated sediment. Proper personal protective equipment will be used to protect workers. Dust control and stormwater management measures will be implemented during the pond dewatering and cap installation. Beneficial effects of implementing Alternative RHP S-3—Capping will be realized upon completion of the cap, which is estimated to take approximately 3 months. The exposure pathway to ecological receptors will be blocked, and surface water will no longer contact contaminated sediment.

Implementability. ***Technical Feasibility.*** In order to implement this alternative, Rhinehart's Pond will need to be dewatered. Surface water will be diverted to the onsite water treatment plant, and temporary holding tanks can be brought onsite to hold additional pond water if necessary. Check dams will be installed upstream of contaminated Massey Run sediment to allow moving impacted stream sediment to the pond. Clean fill for the cap will be transported to the site and stored at a staging area established for fill and equipment. Cap installation will be performed using standard construction equipment, and should be easily implemented.

Administrative Feasibility. Site access will be restricted during cap installation, and fencing will be installed around the pond during cap construction. Because contaminated sediment will remain onsite, a site review will be required every 5 years. Deed restrictions will be created to limit future land uses. Permits will be required for removal activities of Massey Run sediment and moving it to Rhinehart's Pond.

Availability of Services and Materials. Standard earthmoving and construction equipment will be used for this alternative. Clean soil or sediment is available locally to install a cap over contaminated soil.

Cost. Capital costs for acquiring and transporting clean fill, transporting Massey Run sediment to the pond, constructing a sediment cap, implementing site access restrictions, dewatering of pond, treatment of dewatered liquid, and vegetating the sediment cap are estimated to be $445,000. Operation and maintenance costs for the cap, vegetation, and fish tissue monitoring are estimated to be $38,000 per year during the first 5 years. After 5 years, if fish tissue monitoring is discontinued, annual operation and maintenance costs will drop to $15,500 per year. The cost of six 5-year reviews was estimated at $18,800 each. The present worth, based on a 5 percent discount rate, is $835,000. Cost assumptions used to derive these figures are presented in Appendix A, and a cost summary of all alternatives is presented in Table 4-2.

4.1.1.4 Alternative RHP S-4—Removing of Contaminated Sediment, Stabilization, and Disposal at a Subtitle D Landfill

This alternative consists of removing contaminated sediment, dewatering or stabilizing the sediment (if necessary), and disposing of the sediment at a Subtitle D landfill. Figure 4-7 identifies areas to be excavated. Clean sediment that will support the existing ecological wetlands system will be emplaced after the sediment removal. This alternative for sediment includes the following major components:

- Dewater the pond
- Build an earth dam upstream of impacted sediment in Massey Run and divert stream water
- Remove contaminated sediment
- Perform a treatability study to determine sediment moisture content
- Dewater/stabilize excavated sediment (if required)
- Dispose of treated sediment at a Subtitle D landfill
- Place clean sediment in excavated areas (12 inches of sand support layer and 6 inches wetland soil mix)

Overall Protection of Human Health and the Environment. This alternative would attain risk-based remedial action levels for the sediment and would attain RAOs for the site. Alternative RHP S-4—Sediment Removal will achieve a significant reduction in toxicity, mobility, and volume of the contaminants at the site. This alternative may be used with other options, such as capping and institutional controls.

Compliance with ARARs. ***Chemical-Specific ARARs.*** This alternative will remove all sediment that currently contains zinc concentrations at levels that exceed chemical-specific cleanup goals of 1,600 mg/kg. Risks from direct contact with, ingestion of, or inhalation of contaminants will be eliminated onsite. Clean sediment will be used to replace excavated sediment.

Location-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs, and their regulatory citations, are presented in the Final FS (CH2M HILL, March 1998). This alternative will comply with all location-specific ARARs by removing zinc-contaminated sediment that may be the source of risk for area wetlands, ecological receptors, and surface water bodies.

Action-Specific ARARs. Specific requirements of Commonwealth of Virginia and federal ARARs, and their regulatory citations, are presented in the Final FS (CH2M HILLL, March 1998). This alternative will comply with all action-specific ARARs. During removal activities, all measures will be taken to ensure protection of water quality. Stormwater controls will be constructed, dust control measures will be taken, and potentially contaminated runoff will be contained or diverted to the site's water treatment plant. Federal regulations, including transportation and disposal requirements, and Occupational Safety and Health Standards, will be complied with during implementation of this alternative.

Long-Term Effectiveness and Performance. Complete removal of contaminated sediment from Rhinehart's Pond will protect environmental receptors and prevent migration or leaching of contaminants into surface water. To maintain long-term effectiveness, stormwater and groundwater diverted to Rhinehart's Pond from the SDA must be free of contaminants. Addition of contaminated water to the pond could contribute to sediment contamination.

Reduction of Toxicity, Mobility, and Volume. Alternative RHP S-4—Sediment Removal will effectively reduce the toxicity, mobility, and volume of contaminated sediment. With this alternative, the sources of contamination will be removed.

Short-Term Effectiveness. Upon completion of sediment removal activities, installation of new fill (if desired), and revegetation of the pond, contaminants will be eliminated. This alternative achieves RAOs in the short term.

Implementability. ***Technical Feasibility.*** To perform sediment removal activities, Rhinehart's Pond must first be dewatered. Surface water will be diverted to the onsite water treatment plant, and temporary holding tanks can be brought onsite to hold additional pond water if necessary. An earth dam will be constructed in Massey Run to allow sediment streams to be excavated. A concrete drying bed will be constructed to lower the moisture content of excavated sediment. If sediment moisture contents still exceed land disposal requirements, stabilizing agents (concrete or kiln dust, for example) can be added to the sediment. Contaminated sediment will be disposed of at an offsite Subtitle D landfill. The pond sediment will be restored with 12 inches of a sand support layer and 6 inches of clean wetland soil mix. Clean wetlands sediment can be transported to the site and stored at a staging area established for fill and equipment. Upon cap completion, the pond will be vegetated with native plants to control erosion. Vegetation will simulate surrounding wetland plants to achieve the long-term goal of restoring the habitat to precontamination conditions.

Administrative Feasibility. Site access will be restricted during sediment removal and fill activities. Permits will be necessary for diverting stream water and for sediment removal activities.

Availability of Materials and Services. Standard earthmoving and construction equipment will be used for this alternative. Clean soil or sediment is available locally to replace excavated sediment with a 6- to 8-inch layer of clean fill.

Cost. Capital costs for sediment removal for Rhinehart's Pond and the impacted area of Massey Run are estimated to be $658,000. This cost assumes clean soil will be used to line the gravel base once sediment is removed. Vegetation will be planted once sediment removal is complete. The total present-worth cost is $658,000. Cost assumptions are presented in Appendix A, and a cost summary of all alternatives is presented in Table 4-2.

4.2 Comparative Analysis of Sediment Remedial Alternatives

In the following analysis, the remedial alternatives for each area are evaluated in relation to one another for each of the seven criteria. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative. Detailed discussion on the comparative analysis is presented in the Final FS (CH2M HILL, March 1998).

The site-specific sediment RAOs are:

- Prevent ecological exposure to contaminants in the sediment
- Prevent migration and leaching of contaminants in the sediment that may contaminate the surface water

4.2.1 Comparative Analysis of Sediment Remedial Alternatives

The remedial alternatives for the RHP sediment are listed below for clarification of this discussion:

- Alternative RHP S-1—No Action
- Alternative RHP S-2—Limited Action
- Alternative RHP S-3—Capping
- Alternative RHP S-4—Sediment Removal and Offsite Disposal

Table 4-3 presents a summary of this comparative analysis.

4.2.1.1 Protection of Human Health and the Environment

Alternatives RHP S-3 and RHP S-4 would potentially achieve overall protection of human health and the environment. Alternative S-3—Capping would protect receptors by obstructing the existing exposure pathway. Alternative S-4—Sediment Removal would achieve RAOs by removing the contaminated sediment. Overall protection of human health and the environment may not be achieved with Alternatives RHP S-1 and RHP S-2. Alternative RHP S-2—Limited Action Controls may deter some potential ecological receptors, but would not prevent migration of contaminants through surface water.

4.2.1.2 Compliance with ARARs Chemical-Specific ARARs

Alternatives RHP S-1—No Action and RHP S-2—Limited Action do not comply with chemical-specific ARARs for Rhinehart's Pond and Massey Run because all contaminants would be left in place. Alternative RHP S-3—Capping addresses contaminated sediment and risks associated with them by eliminating the potential for ecological exposure to the contamination. Alternative RHP S-4—Sediment Removal will comply with chemical-specific ARARs by completely removing contaminated sediment.

Location-Specific ARARs. Alternatives RHP S-1—No Action and RHP S-2—Limited Action do not comply with location-specific ARARs for Rhinehart's Pond and Massey Run because all contaminants would be left in place. Federal and local wetlands protection regulations and federal rivers protection requirements are applicable at the Rhinehart Tire Fire site. Sediment contaminants could potentially disturb sensitive wetlands or river habitat. Alternative RHP S-3—Capping will comply with location-specific ARARs by preventing migration of contaminants to sensitive ecological areas and receptors. Alternative RHP S-4—Sediment Removal will comply with all location-specific ARARs by removing contaminated media from the site.

Action-Specific ARARs. Action-specific ARARs do not directly apply to Alternative RHP S-1—No Action except during any site walks that may be part of 5-year reviews. Occupational Safety and Health Administration (OSHA) requirements are applicable to all alternatives. Workers will be required to wear appropriate PPE while on the site.

Alternatives RHP S-2, RHP S-3, and RHP S-4 will comply with action-specific ARARs during their implementation.

4.2.1.3 Long-Term Effectiveness and Performance

Alternative RHP S-1—No Action will not be effective over the long-term because this alternative leaves the site in its existing state. Alternative RHP S-2—Limited Action may be effective over the long-term in reducing contaminant exposure to ecological receptors. Institutional controls will be established to deter ecological receptors from using the pond as a habitat, but these controls will not address migration of contamination. Alternatives RHP S-3 and RHP S-4 are expected to be effective over the long-term. Alternative RHP S-3—Capping will require maintenance in the form of monitoring depth of clean sediment cap to ensure that contaminated sediment are not exposed to surface water or other receptors.

4.2.1.4 Reduction of Toxicity, Mobility, and Volume

Alternatives RHP S-1 and RHP S-2 will not reduce the toxicity, mobility, or volume of sediment contamination. Alternative RHP S-3—Capping will achieve a reduction in contaminant mobility and will reduce exposure to contaminants, but will not reduce contaminant volumes. Alternative RHP S-4—Sediment Removal will most successfully reduce contaminant toxicity, mobility, and volume at Rhinehart's Pond and Massey Run.

4.2.1.5 Short-Term Effectiveness

Alternative RHP S-1—No Action will not be effective in the short-term, and will not create any short-term adverse effects. Alternative RHP S-2—Limited Action will achieve its objectives in the short-term, and will create minimal short-term adverse effects. Both Alternatives RHP S-3 and RHP S-4 will achieve their objectives upon implementation. Any short-term adverse effects created by implementation of these alternatives can be easily mitigated.

4.2.1.6 Implementability

Technical Feasibility. Each sediment alternative evaluated is technically feasible. Alternative RHP S-1—No Action calls for no change to the existing site conditions. Alternative RHP S-2—Limited Action involves simple fencing and installation of bird netting, all of which can be performed with general construction measures. Alternative RHP S-3—Capping will require dewatering. Surface water will be diverted to the onsite water treatment plant for treatment and discharge to Massey Run. Temporary holding tanks can be brought onsite to hold additional pond water if necessary. Clean fill for the cap will be transported to the site and stored at a staging area established for fill and equipment. To perform removal activities for Alternative RHP S-4, Rhinehart's Pond must be dewatered using the same techniques described above. A concrete drying bed will be constructed to lower the moisture content of excavated sediment, which will be disposed of at an offsite Subtitle D landfill. Clean fill may be used to line the pond and section of Massey Run after removal is complete. Clean soil for Alternatives RHP S-3 and RHP S-4 can be transported to the site and stored at a staging area established for fill and equipment.

Administrative Feasibility. Each sediment alternative evaluated is administratively feasible. Under Alternatives RHP S-1—No Action, RHP S-2—Limited Action, and RHP S-3—Capping, contaminated sediment will remain onsite, requiring a site review every 5 years. Deed restrictions will be obtained for Alternatives RHP S-2 and RHP S-3 to limit future land uses on the site. Alternative RHP S-4—Sediment Removal will require site access restrictions only during removal activities.

Availability of Materials and Services. This category is not applicable to Alternative RHP S-1—No Action, because under this alternative, all site conditions remain the same. Fencing materials for Alternative RHP S-2—Limited Action are readily available and can be installed using common construction activities. Bird netting can be attained from specialty distributors. Standard earthmoving and construction equipment will be used for Alternatives RHP S-3—Capping and RHP S-4—Sediment Removal. Clean soil or sediment are available locally to install a sediment cap over contaminated soil.

4.2.1.7 Cost

Table 4-2 presents a comparative cost summary of sediment remediation alternatives. Under the NCP, cost is intended as a modifying criteria that plays a secondary role in selection of a remedial alternative. Total present-worth project costs for the four alternatives for RHP sediment range from negligible for Alternative RHP S-1—No Action to $835,000 for Alternative RHP S-3—Capping.

The total present-worth project cost for Alternative RHP S-4—Sediment Removal is estimated to be $658,000. This is the only alternative where no operation and maintenance costs are expected. Alternatives RHP S-1, RHP S-2, and RHP S-3 would require a 5-year site review at a minimum, and Alternative RHP S-3—Capping would require sediment depth monitoring to ensure proper maintenance of the cap.

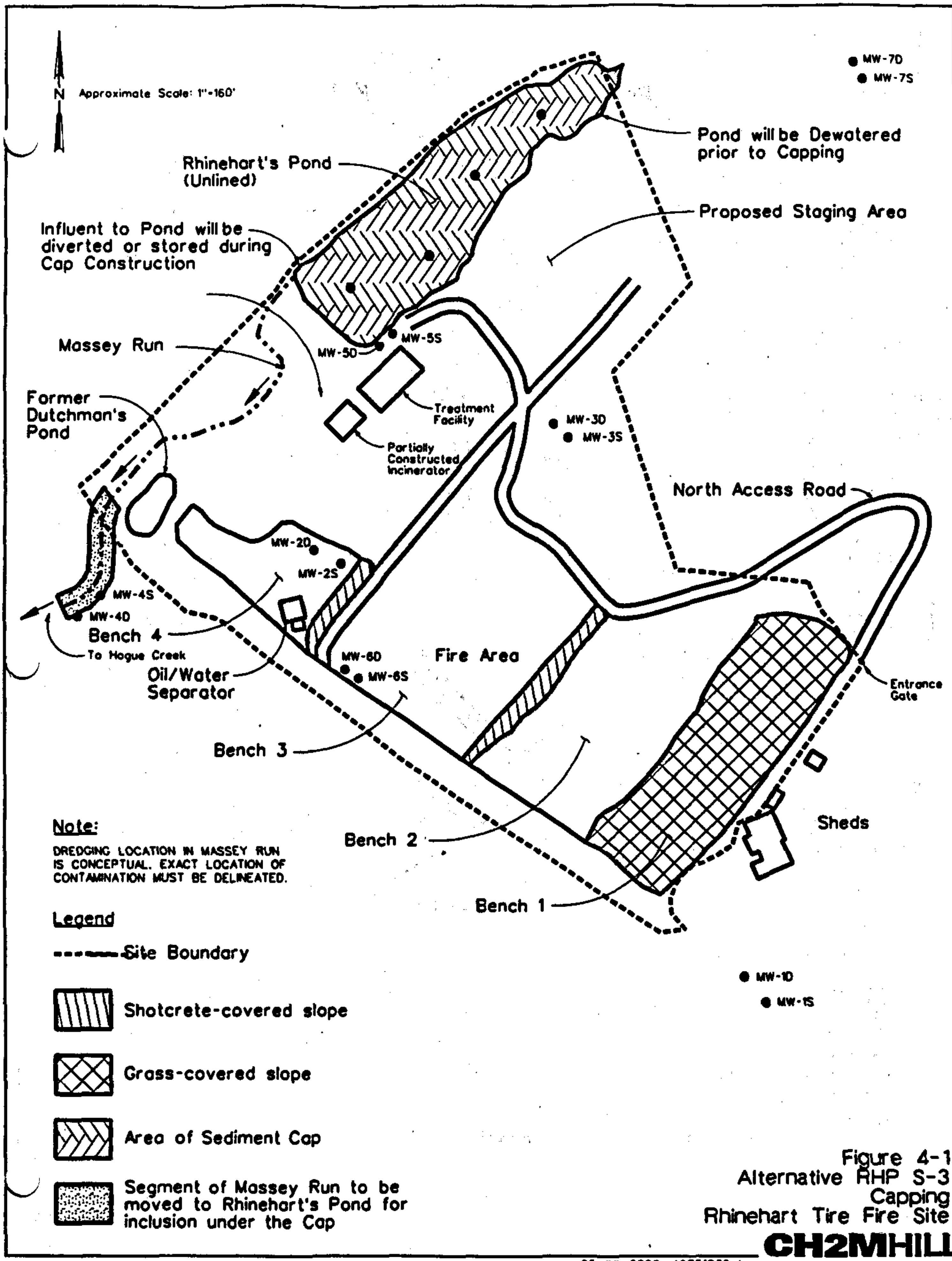

Figure 4-1
Alternative RHP S-3
Capping
Rhinehart Tire Fire Site

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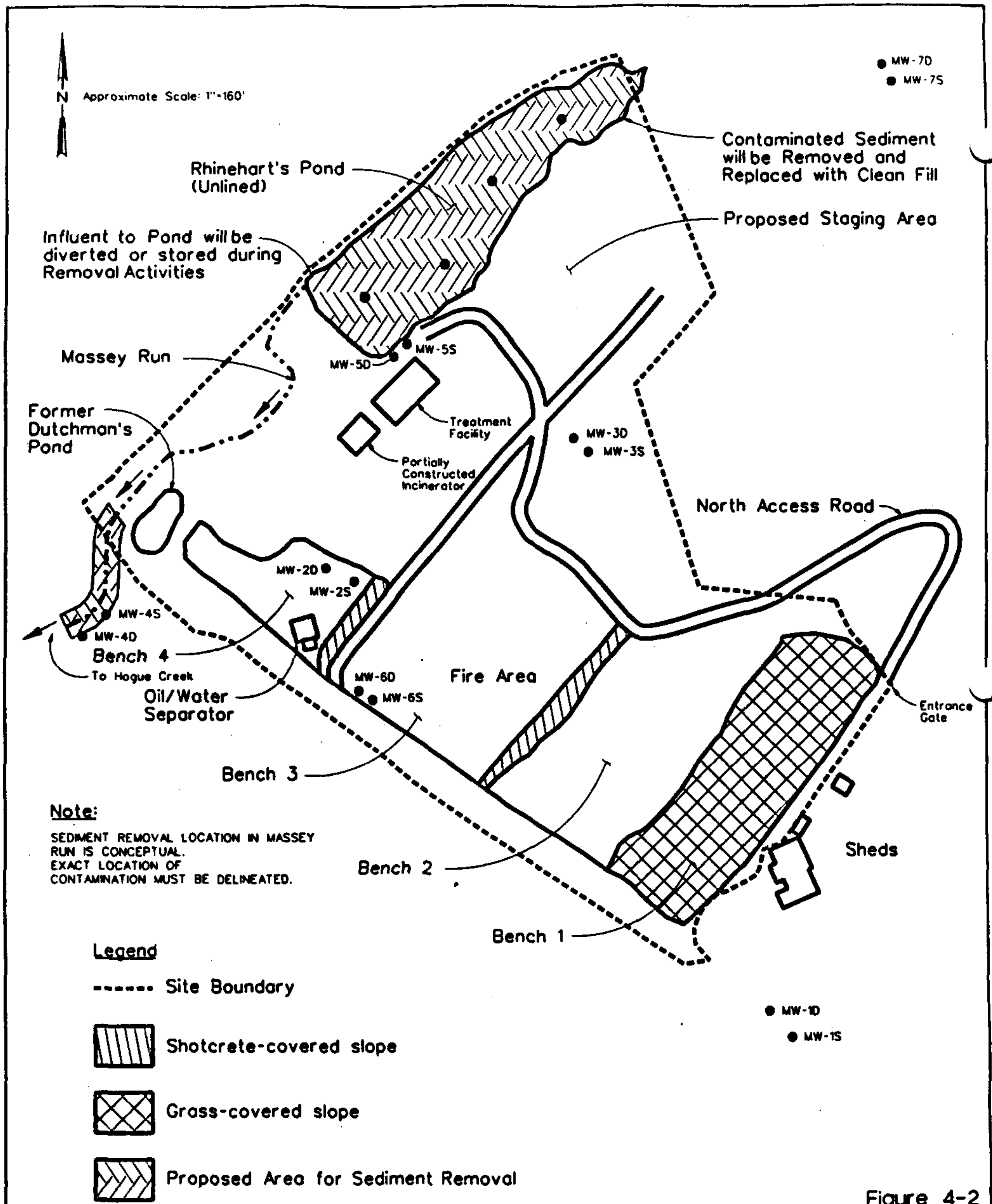

Figure 4-2
Alternative RHP S-.
Removal
Rhinehart Tire Fire Site

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Table 4-1
Rhinehart's Pond Sediment Alternatives
Rhinehart Tire Fire Site

Evaluation Criteria	Alternative RHP S-1 No Action	Alternative RHP S-2 Institutional Controls	Alternative RHP S-3 Capping	Alternative RHP S-4 Removal and Disposal at a Subtitle D Landfill
Protection of Human Health and the Environment	No protection from present contamination levels.	A fence and bird netting would provide a deterrent against direct contact with contaminated soil. Would not completely eliminate contact for environmental or human receptors.	A cap would minimize ecological exposure to contaminated sediment. It would reduce the leaching effects of contaminated sediment to surface water.	Contaminated sediment are excavated and disposed offsite. Therefore, no onsite potential contact or leaching to surface water will exist.
Compliance with ARARs	Because of existing contamination, this alternative does not comply with location-specific or chemical-specific ARARs. Action-specific ARARs not directly applicable since no action occurs.	Because of existing contamination, this alternative does not comply with location-specific or chemical-specific ARARs. May be a viable component of enhancing the effectiveness of other alternatives. Action-specific ARARs are not directly applicable because no action will be undertaken in this alternative that will adequately protect public health and the environment.	Chemical-, location-, and action-specific ARARs would be met by capping, which would prevent future exposures to contaminated sediment.	Chemical-, location-, and action-specific ARARs would be met.
Long-Term Effectiveness and Permanence	Long-term risk remains at current levels or would worsen.	Long-term risk remains at current levels or would worsen. Direct contact risk reduced as long as institutional controls are enforced.	Effectiveness can be maintained through a cap O&M program, including monitoring of cap (clean sediment) depth in the pond.	Removal and disposal off-site is effective in the long-term, and permanent. Onsite risk is minimized; however, contamination is transferred to a Subtitle D landfill. Residual risk at the landfill would be minimal if the landfill is properly operated.
Reduction of Toxicity, Mobility, and Volume	None.	None.	Mobility of contaminated soil is reduced. Toxicity and volume remain constant.	Significant reduction in toxicity, mobility, and volume onsite. Toxicity, mobility, and volume transferred to landfill.

Table 4-1
Rhinehart's Pond Sediment Alternatives
Rhinehart Tire Fire Site

Evaluation Criteria	Alternative RHP S-1 No Action	Alternative RHP S-2 Institutional Controls	Alternative RHP S-3 Capping	Alternative RHP S-4 Removal and Disposal at a Subtitle D Landfill
Short-Term Effectiveness	No short-term effectiveness risk since no action occurs. Risk remains at current levels.	No short-term risk. Risk remains at current levels. Direct contact risk reduced.	Dewatering of pond could harm ecological inhabitants of the pond. Temporary increase in air emissions onsite from cap installation. Benefits from capping alternative will be realized upon completion of cap (approximately 3 months).	Dewatering of pond could harm ecological inhabitants of the pond. Temporary increase in air emissions onsite from dredging activities. Benefits from dredging alternative will be realized upon completion of activities (approximately 4 months).
Implementability	Because contaminants will remain onsite, the NCP requires a 5-year site review.	Because contaminants will remain onsite, the NCP requires a 5-year site review.	Dewatering of pond will be required. Routine construction equipment will be used for cap implementation.	Dewatering of pond will be required. Routine construction equipment will be used for dredging activities. No O&M required.
Cost (Present Worth)	$0 capital cost; $52,000 total for 5-year site reviews (for 30 years) **Total Present-Worth Project Cost: $52,000.**	$59,000 capital cost; $290,000 total O&M for 30 years; $52,000 5-year site reviews (up to 30 years). **Total Present-Worth Project Cost: $400,000.**	$445,000 capital cost; $338,000 O&M for 30 years; $52,000 for 5-year site reviews (up to 30 years). **Total Present-Worth Project Cost: $835,000.**	$658,000 capital cost;. **Total Present-Worth Project Cost: $658,000.**

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Table 4-2
Cost Summary for the Sediment Alternatives
Rhinehart Tire Fire Site

Alternative	Capital Cost ($)	Annual O&M ($/year)	O&M Period (years)	5-year Site Review ($/5 years)	Total O&M Present [a] Worth ($)	Total Present Worth ($)
RHP Sediment Alternatives						
RHP S-1—No Action	0	0	30	18,800	52,000	52,000
RHP S-2—Institutional Controls	59,000	12,500 [c] 35,000 [d]	30	18,800	290,000	400,000
RHP S-3—Capping	445,000	15,500 [c] 38,000 [d]	30	18,800	338,000	835,000
RHP S-4—Removal, Stabilization, and Disposal in a Subtitle D Landfill	658,000	0	0	0	0	658,000

[a] Present-worth costs from operation and maintenance include 5-year site reviews.
[b] Capping costs vary depending on cap construction materials.
[c] Annual operation and maintenance costs after first 5 years.
[d] Annual operation and maintenance costs for the first 5 years. (Fish tissue monitoring costs will be included in O&M for the first 5 years.)
Note: Costs reflected are at the low end of the range. Individual cost tables in Appendix A contain low and high range costs.

Table 4-3
Comparative Analysis Summary of RHP Sediment Remedial Alternatives
Rhinehart Tire Fire Site

Evaluation Criteria	Alternative RHP S-1 No Action	Alternative RHP S-2 Institutional Controls	Alternative RHP S-3 Capping	Alternative RHP S-4 Removal, Stabilization, and Disposal at a Subtitle D Landfill
Overall Protection of Human Health and Environment				
Contact with Contaminated Sediment	No protection from present levels.	Fence and bird netting would provide a deterrent against direct contact with contaminated sediment.	A cap minimizes human and ecological contact with sediment, thus reduces risk from direct contact to sediment and aids in preventing precipitation infiltration. Health risks associated with direct contact, ingestion, and inhalation are effectively reduced onsite.	Sediment above PRGs is excavated and disposed of offsite. Therefore, no onsite potential for human or ecological contact with contaminated sediment.
Sediment Contaminant Migration	Contamination would continue to migrate at present levels.	Contamination would continue to migrate at present levels.	Sediment contamination migration is limited by cap.	All contaminated sediment is removed and disposed of. Therefore, no future migration concerns remain for sediment.
Compliance with ARARs				
Chemical-Specific ARARs	Does not meet any chemical-specific ARARs.	Does not meet any chemical-specific ARARs.	Chemical-specific ARARs would be met by capping which would prevent future exposures to sediment.	Chemical-specific ARARs would be met by remediation.
Location-Specific ARARs	Does not meet any location-specific ARARs.	Does not meet any location-specific ARARs.	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action-Specific ARARs	Not applicable.	Not applicable.	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence				
Sediment	Source not remediated; risk remains.	Source not remediated; fence or bird netting would provide a deterrent against direct contact with contaminated sediment.	Cap can be disturbed, leading to future exposures above health-based risk. Effectiveness can be maintained through a cap O&M program. Contamination migration to groundwater is possible, especially with sediment cap.	Excavation and disposal is highly effective in the long-term. Onsite risk is minimized. However, contamination is transferred to a Subtitle D landfill. *Residual risk at the landfill* would be minimal if the landfill is properly operated.
Need for 5-Year Review	Because contaminated material remains onsite, review would be required to ensure adequate protection of human health and the environment is maintained.	Because contaminated material remains onsite, review would be required to ensure adequate protection of human health and the environment is maintained.	Because contaminated material remains onsite, review would be required to ensure adequate protection of human health and the environment is maintained.	Because contaminated material is removed from the site, review would not be required.

Table 4-3
Comparative Analysis Summary of RHP Sediment Remedial Alternatives
Rhinehart Tire Fire Site

Evaluation Criteria	Alternative RHP S-1 No Action	Alternative RHP S-2 Institutional Controls	Alternative RHP S-3 Capping	Alternative RHP S-4 Removal, Stabilization, and Disposal at a Subtitle D Landfill
Reduction of Toxicity, Mobility, and Volume Through Treatment				
Sediment	None.	None.	No reduction in toxicity or volume. Reduction in mobility because of cap barrier.	Significant reduction of toxicity, mobility, and volume onsite. Significant reduction of toxicity and mobility of the contaminated sediment treated prior to disposal at the landfill. Residual mobility and toxicity at the landfill.
Irreversible Treatment	Not relevant.	Not relevant.	Reversible.	Removal of contaminated media and disposal of material under this alternative is not practically reversible.
Type and Quantity of Residuals Remaining After Remediation	No treatment undertaken. Therefore, all contaminants remain onsite.	No treatment undertaken. Therefore, all contaminants remain onsite.	All contaminants remain onsite.	All contaminated sediment would be removed from the site.
Statutory Preference for Treatment	Does not satisfy.	Does not satisfy.	Does not satisfy.	Satisfies treatment preference for sediment if leaching potential is reduced by stabilization.
Short-Term Effectiveness				
Sediment	No short-term risk since no action occurs. Risk remains at current levels.	No short-term risk. Risk remains at current levels. Construction workers required to use PPE.	Temporary increase in air emissions from installation of cap. Construction workers required to use PPE.	Temporary increase in fugitive emissions from excavation and offsite disposal which is partially controllable by wetting methods. Construction workers required to use PPE.
Time Until Action is Complete	Not applicable.	Fencing of the site and installation of ecological barriers is expected to take 3 weeks.	Site work for installation of a cap is expected to take 3 to 4 months, not including adverse weather delays.	Excavation and disposal of sediment is expected to take approximately 4 to 5 months, not including adverse weather delays.
Implementability				
Ability to Construct and Operate	Not applicable.	Fencing is easily constructed. Minimal O&M.	Routine construction activities, especially for installation of cap. Cap requires O&M.	Routine construction activities required for excavation and disposal of sediment contamination.
Ease of Doing More Action if Needed	Very easy to implement action.	Very easy to implement action.	Further action for sediment remediation can be undertaken by disturbing the cap.	Further remedial action would be easily implemented.
Ability to Monitor Effectiveness	Easily monitored during 5-year site reviews.	Easily monitored during 5-year site reviews.	This alternative can be monitored easily to assess the effectiveness of remediation.	This alternative can be monitored easily to assess the effectiveness of remediation.
Availability of Services, Equipment, and Materials	Not applicable.	Readily available.	Services, equipment, and materials are readily available for all aspects of remediation.	Services, equipment, and materials are readily available for all aspects of remediation.

Table 4-3
Comparative Analysis Summary of RHP Sediment Remedial Alternatives
Rhinehart Tire Fire Site

Evaluation Criteria	Alternative RHP S-1 No Action	Alternative RHP S-2 Institutional Controls	Alternative RHP S-3 Capping	Alternative RHP S-4 Removal, Stabilization, and Disposal at a Subtitle D Landfill
Cost				
Capital Cost	$0	$59,000	$445,000	$658,000
Annual O&M Cost	$0	$ 35,000 (for first 5 years) [a] $12,500 (after first 5 years)	$ 38,000 (for first 5 years) [a] $15,500 (after first 5 years)	0
Present-Worth Cost	$52,000 [a]	$400,000 [b]	$835,000 [b]	$658,000

[a] Includes fish tissue monitoring
[b] Includes present worth of 5-year site review

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5.0 Decommissioning of Site Remedial Facilities

Additional site remedial facilities are currently present on the site. These features are to be decommissioned to aid in the return of the site to the approximate conditions prior to the fire. The other site remedial features that are common to all of the sediment alternatives include:

- Removal of Shotcrete Walls
- Toe Drain System and Underground Piping Removal
- Storm Drain System and Manhole Abandonment
- Removal of Oil/Water Separator and USTs
- Removal of Waste Water Treatment Plant
- Dam Removal
- Sampling Program
- Monitoring Well Abandonment
- Fencing Removal
- Regrading & Final Restoration

The cost for decommissioning of the site remedial features is summarized in Appendix A.

5.1 Removal of Shotcrete Walls

The shotcrete currently covering the slopes between Benches 2 and 3 and Benches 3 and 4 will be removed as part of the decommissioning activities for the site.

The shotcrete surface consists of approximately 3.5" of shotcrete with welded wire fabric underlain by a layer of geocomposite drainage netting. The shotcrete surfaces are anchored to the slopes by 8-foot long steel tie-backs (spaced approximately 5-feet on center) grouted in place. The two shotcrete surfaces cover approximately one acre. Removal of the shotcrete surfaces will include the following:

- Breakup and removal of the shotcrete from the slopes
- Segregation of the shotcrete, metal, and geocomposite materials
- Transportation of the segregated materials to appropriate offsite recycling and disposal facilities

The shotcrete will be broken up and removed from the slopes using standard demolition equipment, such as a hydraulic excavator, a shear, and possibly a hoe ram. The steel anchors will be sheared off at approximately 2 feet below ground surface (bgs), and the remaining 6 feet of anchor will be left in place.

The materials generated during the shotcrete removal will be segregated for transportation to appropriate off-site recycling and disposal facilities. The demolition equipment will be used to separate the debris material. Concrete will be transported to an aggregate recycling facility, wire mesh and steel anchors will be sent to a metals recycling facility, and recovered geocomposite materials will be disposed in a landfill. The cost estimate included in Appendix A for this activity assumes that these materials can be separated. Materials that cannot be separated will likely need to be disposed in a landfill.

Following removal of the shotcrete, the slopes will be regraded to a 3:1 slope; refer to Section 5.10 for further details on regrading and site restoration.

5.2 Toe Drain System and Underground Piping Removal

The toe drain system, which collects water from the bottom of the shotcrete slopes and transports the water to the oil/water separator, will be removed as part of the decommissioning activities. The toe drain system consists of:

- Collection Pipe I – approximately 180 feet of 6-inch diameter perforated pipe which conforms to the toe of the slope between Benches 3 and 4
- Collection Pipe II – approximately 350 feet of 6-inch diameter perforated pipe which conforms to the toe of the slope between Benches 2 and 3
- Collection Pipe III – approximately 240 feet of 6-inch diameter non-perforated pipe which runs along the drainage swale to the east of the benches transporting the captured water to the oil/water separator

The toe drain system piping is approximately two to five feet below grade, covered by gravel, and in some areas covered by the shotcrete. Three manholes are associated with the toe drain system and will be abandoned in place using the same procedure described for the Storm Drain System manholes.

Additional underground piping to be removed from the site includes:

- piping from oil/water separator to storage tanks (will be removed during removal of the tanks)
- oil/water separator by-pass pipe – approximately 50 feet of 6-inch diameter pipe
- storage tanks discharge piping – two approximately 30 foot, 4-inch diameter pipes
- WWTP finished water pipe – approximately 385 feet of 4-inch diameter pipe
- WWTP raw water and drain pipes - two approximately 75 foot, 4-inch diameter pipes

All piping presented above is approximately two to five feet below ground surface, and will be exposed using a backhoe. Line purging will be accomplished by gravity drainage of the pipeline contents. In addition to purging, Collection Pipe III of the toe drain system will also be purged and discharged into the oil water separator. Any water (the pipelines historically only transported water) recovered from the pipelines will be containerized and sampled (refer to the Sampling Program discussed in Section 5.7) and transported for disposal offsite. Once the piping is purged, it will be cut and removed from the trench. The removed piping may be cut further prior to transportation to the metals recycling facility, or landfill. The piping trenches will be backfilled with the original soil.

5.3 Storm Drain System and Manhole Abandonment

The storm drain system, which collects water from Benches 2 and 3, and associated manholes and catchbasins will be abandoned in place as part of the decommissioning activities. The storm drain system consists of three catch basins (Area Inlet 2 [Bench 2], Area Inlet 3 [Bench 3], and Area Inlet 4 [Bench 3]), one manhole (Manhole 2), and 900 feet of 18 and 24 inch reinforced concrete pipe. In addition, the three manholes associated with the toe drain system will be abandoned in place. Abandonment of the storm drain system will involve the following:

- Plug pipe ends at manholes and catchbasins
- Seal/fill manholes/catchbasins with concrete
- Remove top 2 feet of manholes/catchbasins

The piping will be plugged at each catchbasin, at Manhole 2, and at it's outlet using sandbags and concrete. The manholes and catchbasins will then be filled with concrete to approximately two feet below ground surface. The top two feet of the manholes and catchbasins will be removed in order to regrade the area. Backfill will be placed over the abandoned manholes during the regrading and restoration of the site.

5.4 Removal of Oil/Water Separator and USTs

The oil/water separator and the two associated 12,000-gallon water storage tanks will be removed as part of the decommissioning activities. Permits required for removal and disposal of the tanks and their contents will be acquired from local and state authorities. Removal of the tanks and oil/water separator will involve the following:

- Exposure of oil/water separator and tanks using a backhoe or excavator
- Exposure, cutting, and draining of associated piping into tanks
- Removal and pumping of residual sludge and water from the oil/water separator and tanks
- Removal of the oil/water separator and tanks using a backhoe or excavator
- Cleaning and cutting the oil/water separator and tanks for off-site recycling and disposal

The oil/water separator and tanks are approximately 5 to 10 feet below ground surface. The oil/water separator is approximately 11 feet long and has a 4-foot diameter. The atmosphere within the oil/water separator and the tanks will be monitored before tank removal and before cutting the vessels for cleaning. Non-sparking cutting equipment will be used to cut the oil/water separator and tanks into pieces for cleaning and shipment off-site. The oil/water separator, it's internal components, and the tanks will be pressure washed on the existing decontamination pad at the site prior to being transported off-site to a metals recycling facility.

Confirmatory soil samples from the excavation walls and floor may be required as discussed in Section 5.7, Sampling Program. Costs for the confirmatory soil samples have not been included in the cost estimate in Appendix A.

5.5 Removal of Waste Water Treatment Plant

The onsite Waste Water Treatment Plant (WWTP) will be removed as part of the decommissioning activities (anticipated to occur after the wetlands remediation activities). Removal of the WWTP will involve the following:

- Removal of sludges, wastewater, and filter media
- Dismantling the WWTP components
- Pressure washing all surfaces,
- Breaking up concrete slab
- Transportation of concrete to aggregate recycling plant

Prior to demolition of the WWTP, all residual sludge and wastewater will be removed from the facility and sampled and analyzed for disposal characteristics as described in Section 5.7. Residual filter media will also be removed and sampled. The dismantled components of the WWTP will be pressure washed on the existing decontamination pad at the site. The concrete slab will be broken up and demolished using heavy demolition equipment. The concrete will be transported to an aggregate recycling facility.

5.6 Dam Removal

The portion of the dam that was constructed by the U.S. Army Corp of Engineers (ACOE) (an additional 13 feet) will be removed as part of the decommissioning activities. Removal of this portion of the dam will involve the excavation of approximately 16,000 cubic yards of soil. Dam removal activities will include the following:

- Construction of a water diversion
- Excavation of dam materials
- Removal of concrete spillway structures
- Hauling of dam material to benches and slopes
- Restoration of original dam

Prior to commencement of decommissioning activities for the dam, a hydrological analysis including a breach plan, and an erosion and sediment control plan will need to be prepared. A water diversion will be constructed before any excavating work is conducted at the dam. It is assumed that Rhinehart's Pond will be pumped down prior to dam level. Removal of dam materials will begin at the northern end of the dam and move toward the southern end. Materials will be excavated using common hydraulic demolition equipment such as excavators and backhoes. As the earth materials are removed from the dam, they will be hauled to Benches 2 and 3 to be used in the regrading and restoration of the site. The concrete intake structure, 48-inch concrete outlet pipe, and the concrete outlet works will be removed, broken up and transported off-site to an aggregate recycling facility. The original Rhinehart Dam will be restored following the removal of the ACOE dam.

It is assumed that the removal of the dam will not be subject to the Virginia Dam Safety Act, and will not require a permit (based upon a capacity of less than 50 acre-feet).

5.7 Sampling Program

Materials encountered and handled during the decommissioning activities will be sampled and analyzed in order to characterize the materials for off-site disposal. These materials will include the sludges from the oil/water separator and WWTP, filter media from the WWTP, wastewater from the decontamination pad generated during cleaning of the USTs and the WWTP, potential water collected from pipe removal activities, and potentially the aggregate generated from the decommissioning activities. The cost estimate assumes that up to twenty samples may be collected and analyzed for Toxicity Characteristic and Leaching Procedures (TCLP).

Confirmatory soil samples collected from the excavation for the removal of the oil/water separator and storage tanks may be required. These samples would likely be analyzed for inorganics and semi-volatile organic compounds. Costs for these confirmatory samples have not been included in the cost estimate.

5.8 Monitoring Well Abandonment

All 16 monitoring wells that were installed during the RI activities will be abandoned as part of the decommissioning activities. The monitoring wells will be decommissioned using the same procedure as used in the OU3 RI in 1997 (approved by the EPA). The monitoring wells will be abandoned by pulling up the casings and screen, over-reaming the boreholes, and then backfilling the bore hole with 1:4 mix bentonite/cement grout. All grout will be placed from the bottom to approximately 6-inches bgs. For any double-cased wells, which have no well screens, the surface casings will be left in place and then grouted from the bottom up. At least one day after the wells are plugged approximately 6 inches of topsoil will be placed on top of the grout.

5.9 Fencing Removal

Approximately 150 feet of fencing currently exists around the oil/water separator and storage tanks and approximately 600 feet of fence exists along the southern boundary of the site. The fence (posts and screen) will be removed using a backhoe. The fence materials will be sent offsite to a metals recycling facility.

5.10 Regrading and Final Restoration

After demolition and excavation work is complete, portions of the site will need to be regraded and restored. Soil will be used to regrade the shotcrete slopes to an approximate 3:1 slope, to create positive draining on Benches 2 and 3, and to backfill the oil/water separator and UST excavations. Approximately 12,500 cubic yards of soil will need to be transported from elsewhere on the Rhinehart property (borrow area), or imported from off-site, to supplement the approximate 16,000 cubic yards of earth material generated during the dam removal. After regrading is complete approximately 6 inches of topsoil will be placed over all disturbed areas. The topsoil will be spread with a dozer and tracked, seeded, fertilized and mulched using a hydroseeder.

6.0 Summary of Cost

The sediment alternatives and the decommissioning of the other site remedial facilities were discussed separately. The costs associated with the sediment alternatives and the decommissioning of the remedial facilities that are common to each sediment alternative are summarized in Table 6-1.

Table 6-1 Summary of Costs Rhinehart Tire Fire Site			
	Total Present Worth ($)		
Alternative	*Sediment* Alternative	*Decommissioning of* Remedial Features	TOTAL COST
RHP S-1—No Action	$ 52,000	$ 889,000	$ 941,000
RHP S-2—Institutional Controls	$ 400,000	$ 889,000	$ 1,289,000
RHP S-3—Capping	$ 835,000	$ 889,000	$ 1,724,000
RHP S-4—Removal, Stabilization, and Disposal in a Subtitle D Landfill	$ 658,000	$ 889,000	$ 1,547,000

7.0 References

CH2M HILL, February 1998. *Final Rhinehart Tire Fire Site Operable Unit 3 Remedial Investigation Report*. February, 1998.

CH2M HILL, March 1998. *Final Rhinehart Tire Fire Site, Operable Unit 3 Feasibility Study Report.*

CH2M HILL, 2000a. Memorandum to Stephanie Dehnhard, *Subject: Revised Table A-9 for the Feasibility Study to include Additional Background Groundwater Sampling Activities, Rhinehart Tire Fire Site, VA*. January 6, 2000.

CH2M HILL, 2000b. Memorandum to Stephanie Dehnhard, *Subject: Final Technical Memorandum on Additional Background Groundwater Sampling Activities, Rhinehart Tire Fire Site, VA*. January 6, 2000.

Appendix A

Cost Estimates

Appendix

General Cost Assumptions

The accuracy of cost estimates presented in this report are sufficient for feasibility-level decisions, suitable for use in project planning and basic decision making to support remedial alternative selection. The expected accuracy of the cost estimates is consistent with the objectives of the feasibility study, and with CERCLA guidance. Final project costs are expected to vary from these estimates due to market conditions, final project scope, actual labor and material costs at the time of construction, site conditions, productivity, final project schedule, permit or ARARs constraints, and other factors.

Quantity estimates were made based on information contained in the Remedial Investigation Final Report, Phase II, Rhinehart Tire Fire Site, Prepared by Fred C. Hart Associates, Inc., August 5, 1988; and the Design Drawings, Rhinehart Tire Fire Superfund Site, Prepared by U.S. Army Engineer District, Corps of Engineers, Omaha, NE, May 1990. Unit costs were based on typical values available in estimating guides, and experience of construction professionals with similar projects.

The present worth of Operation and Maintenance and 5-year review costs was estimated using a 5 percent discount rate for a 30-year period, except for fish tissue sampling where a 5-year period was used.

The range of unit costs and total costs reflected in the alternative cost estimates are based upon a sensitivity analysis. A cost sensitivity analysis could also have been applied to quantity variations. However, the unit cost ranges applied, coupled with a typical overall contingency of 25%, are considered adequate to address cost sensitivity for the purpose of a CERCLA feasibility study with an expected overall accuracy of +50%/-30%.

RHINEHART TIRE FIRE SITE - POND AREA
COST ESTIMATE FOR SEDIMENT REMEDIAL ALTERNATIVE RHP S-2
INSTITUTIONAL CONTROLS

Date: 02-Aug-00

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST ($) LOW	UNIT COST ($) HIGH	TOTAL COST ($) LOW	TOTAL COST ($) HIGH
1.0 LEGAL	LS.	1	10,000	12,500	10,000	12,500
2.0 SITE SECURITY						
2.1 *Security Fence*	LF.	1,100	20	22	22,000	24,200
Subtotal - Direct Construction Total (DCT)					$ 32,000	$ 36,700
Design, EPA Deliverables and Resident Engineering					$ 15,000	$ 17,500
Subtotal - Total Capital Cost (TCC)					$ 47,000	$ 54,200
Contingency (25% of TCC)					$ 11,750	$ 13,550
TOTAL CAPITAL COST					$ 58,750	$ 67,750
PRESENT WORTH O&M COST(from below)					$ 341,732	$ 341,732
TOTAL PRESENT WORTH PROJECT COST					$ 400,482	$ 409,482

Operation and Maintenance (O&M) Costs

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST (&)
3.0 INSTITUTIONAL ADMINISTRATION	LS.	1	5,000			$ 5,000
4.0 FENCE/GENERAL MAINTENANCE	LS.	1	5,000			$ 5,000
5.0 FISH TISSUE SAMPLING/ANALYSIS (5 yrs)						
5.1 Sampling/Preparation and Reporting	Event	9	1500			$ 13,500
5.2 Laboratory Analysis	Samples	45	100			$ 4,500
Total Annual Cost, Items 3.0 and 4.0						$ 10,000
Contingency (25%), Items 3.0 and 4.0						$ 2,500
Total Annual Cost, Item 5.0						$ 18,000
Contingency (25%), Item 5.0						$ 4,500
Subtotal, Annual Cost, Items 3.0 and 4.0						$ 12,500
Subtotal, Annual Cost, Item 5.0						$ 22,500
Present Worth Annual O&M (30-yrs, i=5%) - Items 3.0 and 4.0 only for 30 years						$ 192,156
Present Worth Annual O&M (5-yrs, i=5%) - Item 5.0 only for 5 years						$ 97,413
Total Present Worth O&M						$ 289,569

5 Year Site Reviews

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST (&)
6.0 5 Year Site Reviews	LS.	1	15,000			15,000
Total 5-year Cost						$ 15,000
Contingency (25%)						$ 3,750
Subtotal						$ 18,750
Present Worth Over 30 years (30-yrs, i=5%)						$ 52,163
Total Present Worth O&M						$ 52,163

NOTES:
Refer to the General Cost Assumptions included in this Appendix.

RHINEHART TIRE FIRE SITE - POND AREA
COST ESTIMATE FOR SEDIMENT REMEDIAL ALTERNATIVE RHP S-3
CAPPING

Date: 23-Oct-97

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST ($) LOW	UNIT COST ($) HIGH	TOTAL COST ($) LOW	TOTAL COST ($) HIGH
1.0 MOBILIZATION/DEMOBILIZATION	LS	1	10,000	15,000	10,000	15,000
2.0 SITE PREPARATION						
2.1 Dewater Pond, 50,000 gallons +/-	LS	1	10,000	15,000	10,000	15,000
2.2 Diversion System for Stormwater	LS	1	20,000	35,000	20,000	35,000
2.3 Water Pumping/Treatment/Discharge	GAL	150000	0.05	0.10	7,500	15,000
3.0 REMOVAL AT MASSEY'S RUN						
3.1 Clearing and E&S Controls (check dams)	LS	1	1,500	2,000	1,500	2,000
3.2 Temporary Pump-Around	LS	1	1,000	1,500	1,000	1,500
3.3 Excavate and Load Sediments	CY	15	15	20	225	300
3.4 On-site Haul to Rhinehart Pond	LS	1	100	150	100	150
4.0 CAP CONSTRUCTION						
4.1 Grading and Bulky Object Removal	LS	1	20,000	30,000	20,000	30,000
4.2 10 oz. Geotextile Fabric	SF	56628	0.50	0.75	28,314	42,471
4.3 6 in. Sand/Gravel Layer	CY	2622	18	22	47,190	57,677
5.0 RESTORATION						
5.1 6 in. Wetlands soil mix	CY	2622	20	25	52,433	65,542
5.2 Planting - Submerged and Bordering	acre	2	10,000	12,000	18,000	21,600
5.3 Sediment/Storm Water Controls	LS	1	10,000	15,000	10,000	15,000
5.4 Seeding/Mulching, surrounding area	acre	1	3000	4000	3,000	4,000
6.0 SITE SECURITY						
6.1 Temporary Security Fence	LF	1100	10	12	11,000	13,200
7.0 SITE MANAGEMENT	months	2	12,500	15,000	25,000	30,000
8.0 Legal	LS	1	4,000	6,000	4,000	6,000
Subtotal - Direct Construction Total (DCT)					$ 269,262	$ 369,439
Contractor's Indirect Costs (10% of DCT)					$ 26,926	$ 36,944
Design, EPA Deliverables and Resident Engineering					$ 60,000	$ 80,000
Subtotal - Total Capital Cost (TCC)					$ 356,189	$ 486,383
Contingency (25% of TCC)					$ 89,047	$ 121,596
TOTAL CAPITAL COST					$ 445,236	$ 607,979
PRESENT WORTH O&M COST(from below)					$ 389,771	$ 389,771
TOTAL PRESENT WORTH PROJECT COST					$ 835,006	$ 997,750

Operation and Maintenance (O&M) Costs

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST ($)
9.0 INSPECTION, REPORT	LS	1	7,500			$ 7,500
10.0 COVER/ROAD MAINTENANCE	LS	1	5,000			$ 5,000
11.0 FISH TISSUE SAMPLING/ANALYSIS (5 yrs)						
11.1 Sampling/Preparation and Reporting	Event	9	1500			$ 13,500
11.2 Laboratory Analysis	Samples	45	100			$ 4,500
Total Annual Cost, Items 9.0 and 10.0						$ 12,500
Contingency (25%), Items 9.0 and 10.0						$ 3,125
Total Annual Cost, Item 11.0						$ 18,000
Contingency (25%), Item 11.0						$ 4,500
Subtotal, Annual Cost, Items 9.0 and 10.0						$ 15,625
Subtotal, Annual Cost, Item 11.0						$ 22,500
Present Worth Annual O&M (30-yrs, i=5%) - Items 9.0 and 10.0 only for 30 years						$ 240,195
Present Worth Annual O&M (5-yrs, i=5%) - Item 11.0 only for 5 years						$ 97,413
Total Present Worth O&M						$ 337,608

5 Year Site Reviews

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST ($)
12.0 5 Year Site Reviews	LS	1	15,000			15,000
Total 5-year Cost						$ 15,000
Contingency (25%)						$ 3,750
Subtotal						$ 18,750
Present value of series of 6 intervals of 5 years(30yrs, i=5%)						$ 52,163
Total Present Worth O&M						$ 52,163

NOTES:
Refer to the General Cost Assumptions included in this Appendix.

RHINEHART TIRE FIRE SITE - POND AREA
COST ESTIMATE FOR SEDIMENT REMEDIAL ALTERNATIVE RHP S-4
DREDGING OF CONTAMINATED SEDIMENTS, TRANSPORTATION, AND OFF-SITE DISPOSAL

Date: 02-Aug-00

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST ($) LOW	UNIT COST ($) HIGH	TOTAL COST ($) LOW	TOTAL COST ($) HIGH
1.0 MOBILIZATION/DEMOBILIZATION	LS	1	20000	25000	20,000	25,000
2.0 LEGAL	LS.	1	7,500	10,000	7,500	10,000
3.0 SITE SECURITY						
3.1 Temporary Security Fence	LF.	1,100	10	15	11,000	16,500
4.0 SITE PREPARATION						
4.1 Dewater Pond, 50,000 gallons +/-	LS.	1	10,000	15,000	10,000	15,000
4.2 Diversion System for Stormwater	*LS.*	*1*	*20,000*	*35,000*	*20,000*	*35,000*
4.3 Water Pumping/Treatment/Discharge	GAL.	150,000	0.05	0.10	7,500	15,000
4.4 Construct Sediment Dewatering Pad	LS.	1	15,000	20,000	15,000	20,000
5.0 SEDIMENT DREDGING/DEWATERING						
5.1 Dredging	CY	1,000	20	25	20,000	25,000
5.2 Drying/Dewatering on Concrete Pad	CY	1,000	10	15	10,000	15,000
5.3 Bulking and Loading	CY	1,000	4	8	4,000	8,000
6.0 REMOVAL AT MASSEY'S RUN						
6.1 Clearing and E&S Controls (check dams)	LS	1	1,500	2,000	1,500	2,000
6.2 Temporary Pump-Around	LS	1	1,000	1,500	1,000	1,500
6.3 Excavate and Load Sediments	CY	15	15	20	225	300
6.4 On-site Haul to Staging Area	LS	1	100	150	100	150
7.0 TRANSPORTATION AND DISPOSAL						
7.1 Transportation	TONS	1,200	30	40	36,000	48,000
7.2 Disposal at Solid Waste Landfill	TONS	1,200	80	100	96,000	120,000
8.0 RESTORATION						
8.1 6 in. Wetlands soil mix	CY	2622	20	25	52,433	65,542
8.2 12 in. Sand support layer	CY	5243	8	12	41,947	62,920
8.3 Planting - Submerged and Bordering	acre	1.8	10,000	12,000	18,000	21,600
8.4 Sediment/Storm Water Controls	LS	1	10,000	15,000	10,000	15,000
8.5 Seeding/Mulching, surrounding area	acre	1	3000	4000	3,000	4,000
9.0 SITE MANAGEMENT	months	2	12,500	15,000	25,000	30,000
Subtotal - Direct Construction Total (DCT)					$ 410,205	$ 555,512
Contractor's Indirect Costs (10% of DCT)					$ 41,021	$ 55,551
Design, EPA Deliverables and Resident Engineering					$ 75,000	$ 100,000
Subtotal - Total Capital Cost (TCC)					$ 526,226	$ 711,063
Contingency (25% of TCC)					$ 131,556	$ 177,766
TOTAL CAPITAL COST					$ 657,782	$ 888,829
PRESENT WORTH O&M COST					$ -	$ -
TOTAL PRESENT WORTH PROJECT COST					$ 657,782	$ 888,829

Operation and Maintenance (O&M) Costs

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST ($)
10.0						$ - $ -
Total Annual Cost						$ -
Contingency (25%)						$ -
Subtotal						$ -
Present Worth Annual O&M (5-yrs, i=5%)						$ -
Total Present Worth O&M						$ -

5 Year Site Reviews

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)			TOTAL COST ($)
11.0 5 Year Site Reviews	LS.	0	0			0
Total 5-year Cost						$ -
Contingency (25%)						$ -
Subtotal						$ -
Present Worth Over 30 years (30-yrs, i=5%)						$ -
Total Present Worth O&M						$ -

RHINEHART TIRE FIRE SITE
COST ESTIMATE FOR DECOMMISSIONING OF SITE REMEDIAL FACILITIES

Date 25-Jul-2000

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT COST ($) LOW	UNIT COST ($) HIGH	TOTAL COST ($) LOW	TOTAL COST ($) HIGH
1.0 **MOBILIZATION/DEMOBILIZATION (add'l to S-4)**	LS	1	3,000	5,000	3,000	5,000
2.0 SITE PREPARATION						
2.1 Install Erosion & Sedimentation Controls	LS	1	2,500	5,000	2,500	5,000
2.2 Clearing by Dam Area	acre	0.5	2,000	2,500	1,000	1,250
2.3 Prepare Haul Roads and Establish Support Zone	LS	1	7,000	8,000	7,000	8,000
3.0 **DEMOLITION**						
3.1 Remove Shotcrete Walls (Excavator & Shear)	LS	1	80,000	95,000	80,000	95,000
3.2 Remove USTs and Oil/Water Separator	LS	1	8,000	10,000	8,000	10,000
3.3 Remove/Wash Wastewater Treatment Equipment	LS	1	5,000	8,000	5,000	8,000
3.4 Remove WWTP Concrete Slab	SF	1000	1.50	2.50	1,500	2,500
3.5 Remove Toe Drains/ Underground Piping	LF	1500	10	12	15,000	18,000
3.6 Abandon Manholes and Catch Basins	EACH	7	1,000	1,500	7,000	10,500
3.7 Segregation and Loading (all materials)	LS	1	20,000	30,000	20,000	30,000
3.8 Fence Removal	FOOT	750	10	12	7,500	9,000
4.0 **OFF-SITE RECYCLING**						
4.1 Concrete Recycler (Shotcrete Walls, WWTP, Dam) - 1200 tons in 22 ton loads, approx. 55 loads	LOAD	55	25	30	1,375	1,650
4.2 Hauling to Concrete Recycler (90 mile haul)	LOAD	55	200	225	11,000	12,375
4.3 Metal Recycling (Haul cost per 30 cy load)	EACH	12	200	250	2,400	3,000
4.4 T&D of Misc. Materials at Subtitle D Landfill	LOAD	8	300	400	2,400	3,200
4.5 T&D of Sludge from O/W Separator and WWTP	Drums	15	600	1,000	9,000	15,000
4.6 T&D of Filter Media	Tons	20	180	225	3,600	4,500
4.7 T&D of Decontamination Water	LOAD	2	1,000	1,200	2,000	2,400
4.8 Waste Characterization Testing (TCLP)	EACH	20	550	600	11,000	12,000
5.0 **DAM REMOVAL AND SITE WORK**						
5.1 Construct Water Diversion	EACH	1	10000	15000	10,000	15,000
5.2 Excavate and Remove Dam	CY	15500	2.00	3.00	31,000	46,500
5.3 Remove Concrete Structures at Dam	LS	1	10,000	15,000	10,000	15,000
5.4 Haul Material to Benches & Slopes	CY	15500	2.50	3.00	38,750	46,500
5.5 Backfill Material	CY	12500	8	18	100,000	225,000
5.6 Place and Compact Backfill	CY	28000	2.00	2.50	56,000	70,000
5.7 Restore Channel in Former Dam Area	LS	1	20000	25000	20,000	25,000
6.0 **MONITORING WELL ABANDONMENT**						
6.1 Driller Mob/Demob	LS	1	2000	2500	2,000	2,500
6.2 Abandon Shallow Monitoring Well	EACH	8	1500	2000	12,000	16,000
6.3 Abandon Deep Monitoring Well	EACH	8	3000	4000	24,000	32,000
7.0 ***FINAL RESTORATION***						
7.1 Imported Topsoil	CY	2500	18	25	45,000	62,500
7.2 Spread Topsoil	CY	2500	2.00	3.00	5,000	7,500
7.3 Seed, Fertilizer, Mulch	ACRE	9	3,000	4,000	27,000	36,000
7.4 Additional Drainage Improvements	LS	1	5,000	10,000	5,000	10,000
8.0 **SITE MANAGEMENT (addition to Alt S-4)**	months	3	5,000	10,000	15,000	30,000
Subtotal - Direct Construction Total (DCT)					$ 601,025	$ 895,875
Contractor's Indirect Costs (10% of DCT)					$ 60,103	$ 89,588
Design, EPA Deliverables and Resident Engineering (In addition to S-4 Alt.)					$ 50,000	$ 60,000
Subtotal - Total Capital Cost (TCC)					$ 711,128	$ 1,045,463
Contingency (25% of TCC)					$ 177,782	$ 261,366
TOTAL CAPITAL COST					$ 888,909	$ 1,306,828
PRESENT WORTH O&M COST (from below)					$ -	$ -
TOTAL PRESENT WORTH PROJECT COST					$ 888,909	$ 1,306,828

NOTES:

1 The cost estimates for these actions assume that the work will be performed at the same time and by the same contractor, as the sediment remedial action.

2 Costs presented in items 3.7 and 4.1 - 4.4 assume separation of concrete and metal is feasible during shotcrete removal.

3 Range of the earthfill unit costs in item 5.5 reflects use of on-site versus off-site borrow material.

4 Quantities above are estimates and are based upon Plans and As-Builts provided by U.S. EPA Region III.

5. Costs shown above are additive to Sediment Alternative S-3 or S-4 costs, assuming the work is performed concurrently with the sediment remedial activities. If the decommissioning activities are combined with sediment Alternative S-1 or S-2, costs associated with mob/demob (Item 1.0), site management (Item 8.0), and design, deliverables, and resident engineering will likely increase

6 Refer to the General Cost Assumptions included in this Appendix.